AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

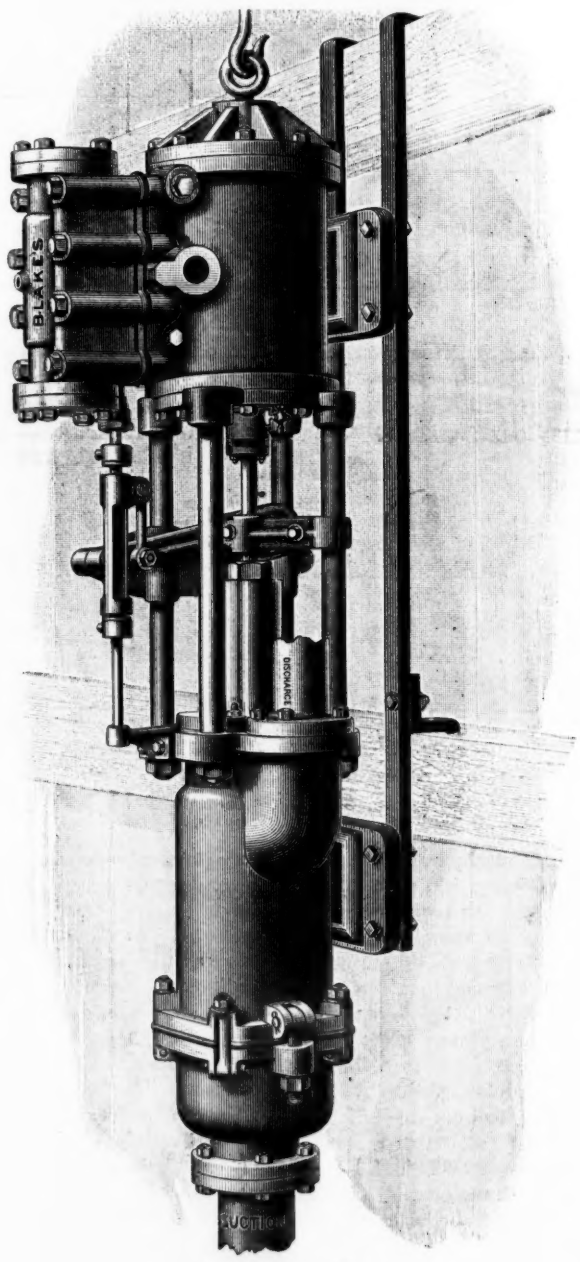
New Sinking Pump.

We herewith present an engraving of a new vertical mining pump, made by the George F. Blake Manufacturing Co., of 88 Liberty street, New York, and especially adapted for sinking new shafts, or for recovering old mines that have been "drowned out." The pump, being vertical, requires but little room in the shaft, and having wrought iron dogs attached to the cylinder it can be hung on the shaft timbering. For lowering or raising the pump, there is provided a strong ring-bolt, firmly embedded in the upper steam cylinder head, which, as the engraving shows, is webbed, to give extra strength and solidity.

The special feature of this pump over others of the same class is in the arrangement of its water cylinder. This has but one plunger, and yet the pump is double-acting in its operation. This result is obtained by making the plunger of such shape that it has two effective pumping areas, as in the "bucket-plunger" pump. In short, the plunger is enlarged at its lower end, the upper part working through an ordinary stuffing-box, packed from the outside. The lower or enlarged part works in a cylinder lined with a patent removable bushing of hard composition, and is packed with Tuck's fibrous packing. This end of the plunger contains the delivery valve, which is made of vulcanized rubber. Ports of sufficient area are let into the plunger below and above this valve. The suction valves are in the lower section, near the suction nozzle. The upper part of the plunger serves very effectively as an air chamber.

In operation the suction is intermittent (every other stroke), but the delivery is constant and continuous, as in the regular bucket-plunger form of pump.

The size of the pump illustrated is as follows: Steam cylinder, 10″ diameter; upper part of water-plunger, 5″ diameter; lower part of plunger, 7″ diameter; stroke, 12 inches. The pump weighs about 1,300 lbs., and has a capacity of 100 to 150 gallons per minute.



NEW SINKING PUMP.

Repairing Boiler Tubes.

The question: What is the best method of repairing tubes—welding tubes for locomotive boilers?—was discussed as follows at the Master Mechanics' Convention:

THE PRESIDENT.—I understand that there are in the country master mechanics who are using very much improved methods over the old way; and I present this question to draw them out and find out whether there is not something better in the way of welding tubes than to put them on the horn of an anvil and weld them with a hammer.

I know that there are several machines that have been designed to weld iron tubes, and I would like to get at which is the best. I propose to procure a machine for welding flues, and I ask this question for information. I don't want to make a mistake in getting a machine. I should be mortified to buy a machine and find I had made a mistake.

MR. FRY.—I made a very careful investigation of the subject you refer to a short time ago. I was led to do so from the fact that a gentleman with whom I am very well acquainted, was superintendent of Motive Power of the Chicago and Grand Trunk Railroad, running from Port Huron to Chicago, had many years ago invented a machine for welding flues. I had seen it in his shop. It was made in a very rough manner, out of material that he could find lying about the shop, and did the work very effectively when I saw it. But I had heard nothing of it since. I visited his place a few months ago, and I found the blacksmith was actually using the tool. I let him know that I was acquainted with the superintendent, and drew him out as to the merits of this tool. I found that it had been working constantly for five years; that it had cost very little to repair, and that it was an extremely satisfactory method of welding tubes; that it had very largely reduced the cost and enabled them to do the work very much quicker; and, what was more satisfactory, had so increased the certainty of the work that they had abandoned the usual hydraulic test after that. I don't know that this machine has ever been made for the market. I believe it has not; because I inquired if I could buy one, and was told I should have to get one from the superintendent. The rapidity with which it works is wonderful. I then visited shops under the charge of Mr. Sedgley, and found a tool working on an entirely different principle. It was a roller; the first machine I saw was a steam hammer. Mr. Sedgley was using a tool which I believe is in the market, and can be purchased. They both did their work equally fast. About seven seconds is the time taken to weld a tube; and, apparently, they do their work equally well. There are some advantages in the steam hammer which would lead me to think it the better tool; but probably another gentleman would prefer the other. But it did seem to me, after making that examination, perfectly extraordinary that we should have been going on with the old hand welding so long when two different machines are in operation which so successfully perform this very necessary work of welding tubes. I think it is very wonderful that there are not more used than are.

MR. SEDGLEY.—I would like to ask the gentleman last up what portion of the work the machine that he saw in Canada did towards repairing tubes? Does it cut off the tube, or do the tubes have to be cut off in a lathe before they go under the hammer? I would like to know, in other words, the amount of the service that that machine performs. We are using a machine for that purpose. We have had it in use perhaps two or three years. It does all the work. You take the tube as it comes from the boiler. It cuts it off and scarfs it. It scarfs it at the same time it cuts it off. The pieces are then put together and welded. I would state that it takes a different roll for each weld. Those machines, under ordinary circumstances, would weld about one hundred tubes a day, costing, probably (we use very cheap labor), 2¼ cents per tube for labor. It does the work so perfectly that we never test the tubes with hydraulic pressure. We never have a leaky tube from the weld. I should like to know what proportion of the work this machine, which Mr. Fry speaks of, does. Of course, you all know, it is an expensive job to cut the tube off in the lathe before you scarf it; it also requires time to cut the piece; but if it can all be done at the same heat at which the scarf is prepared, I think there is a decided gain in the machine that does that.

MR. PRESCOTT.—We are using a machine similar to that which Mr. Sedgley describes. We take the flues from the boiler just as they are cut up. In cutting off the end, we cut it with these revolving rollers, and scarf it at the same time, and then change the rolls and commence weld'ng up; and we think we save a good deal by it. I have done two hundred and twenty flues per day. The pieces have been properly scarfed before with the other set of rolls. It saves the heating of the flue, after it is welded, to be annealed. When we weld them, we place them at once into dry sand in a box, and then when we get the length of the flue, we weld it up again and cut the other end off, and we set that in the sand, and the cutting and annealing is all done. The cost is about seven cents a flue to take them out, weld them, fit them up, and set them back again. We don't have to test any of our flues. If there is any imperfection in the flues, you can see the black streak. We don't find any trouble with that at all. The amount it can do depends altogether upon the amount of fire you have to do the heating. You can weld them just as fast as the man can put them in the machine and take them out. The man holding the flue has full control by a treadle. I think it is the best thing we have got hold of yet. It is made, I think, in Cleveland. I forget the name of the maker just now.

MR. FRY.—Replying to Mr. Sedgley's question, I may say that the tool I saw at Port Huron did not cut off the ends; that was done in a lathe; all the other work was done by the machine. It scarfed the ends and drew down the end of the tube and welded the two together, and then drew down the end of the copper ferrule which was used. The cost per tube given me was, curiously enough, just the same as that mentioned by the last gentleman. In each case, the people using the tools thought the one they used the best. It seemed demonstrated to my mind that they were excellent machines for doing that work.

MR. HAYES.—I would like to ask Mr. Fry

if he knows about the cost of this tool that he saw in Canada.

MR. FRY.—The foreman of the shop told me that they had made that one they had themselves. It was very roughly made out of old things that they had picked up, and probably had not cost them a hundred dollars to make. The superintendent of the works told me that they had never sold any. It was some time ago they told me that, however. He said that if he did sell any he did not propose to sell cheaper than anybody else. He said, "If you want one, you will have to pay me whatever the market price is." I do not suppose, unless some manufacturer would take it up, that it would have a price at all proportionate to its first cost.

MR. PRESCOTT.—The machine I had reference to is sold for $600.

THE PRESIDENT.—It seems to me, gentlemen, that in a matter of this kind the first cost of the machine is of very little account, always providing we do not get swindled in paying more than the machine is worth. But the interest on the amount saved by the use of one of those machines on any large road would soon pay for the machine, even at $600, which is a large price; but on the roads in the Western country cheap welding is a very important matter, and a road that has 300 to 600 engines has use for that machine all the time. Perhaps I ought to qualify that a little. If a man can weld 200 a day, they would not have use for the machine all the time. The evidence presented here now is that we have two machines in use that will do the work, and do it satisfactorily. One is not in the market; it has merit undoubtedly. The other is in the market, as I presume, and I suppose Mr. Sedgley can tell us where to get a machine, if we want one.

MR. HACKNEY.—I have got two of these machines running, and all that has been said about it I can indorse. I have not much to say further than that they are a perfect machine for flue welding.

MR. SEDGLEY.—I will say, for the information of the gentlemen present, that those machines are made at Cleveland. We had the first one, I think, put in our shop, and many of the members, perhaps, saw it two years ago, when the Convention was at Cleveland.

Chinese Ingenuity.

Consul Stevens writes from China as follows:

"The Department requires us to report any new inventions we may see or that may come before our observation. Thus far I have seen but two. The first is a pump. I remember when I was a small boy, out in Illinois, men came around to sell a new invention, called a chain pump. The same pump has been used here for more than two thousand years. The second is double-headed tacks. No one can tell me how long they have been in use here. There are many articles in use among the Chinese that could be advantageously introduced in America, of which I have been trying to get some drawings, but they are not yet ready, and will not be in time for this report. They will, however, be forwarded as soon as possible. These implements and machines are very crude, the people being very poor, as a general thing, and utilize everything in their power; they count, almost, the blades of grass; how much it will take to boil a cup of tea or cook their rice; they never waste for themselves, they only *squeeze* foreigners.

It is rather tantalizing for patrons of suburban railways in this part of the country to read that a conductor has been arrested in the West for running his train too fast.—*Boston Bulletin.*

Copper-coated iron tubes are being tried in some of the locomotives of the London and North-Western Railroad.

The coal fields of the United States have an area of nearly 200,000 square miles, or ten times that of all the other coal-producing countries in the world.

Weighting Down Copes—Damp Foundry Floors.

BY THOS. D. WEST.

Melted iron supports and floats a body the specific gravity of which is not greater than its own, the same as water or any other fluid. Solid cold iron floats on the top of melted iron just as ice floats on water. Water, when frozen, expands, but the expansion does not make the body any heavier or lighter. A definite quantity of water weighs the same whether liquid or frozen. Water in changing to ice expands about one-ninth of its bulk, which makes ice specifically lighter than water, and therefore it swims or floats on it, about eight times as much being below as above the surface.

An iron ship sinks until it displaces water equal to its weight and then floats; but if the same quantity of iron were in a solid mass, it would instantly sink to the bottom.

In each of the above cases the cause is quite plain; but in the instance of iron floating on iron, the matter is somewhat complicated.

If the same law holds good with reference to both the water and iron, the iron when melted must be specifically heavier than it is when cold, or iron when cold must be more bulky than when hot, and what expansion takes place must occur when the iron cools. But to say that iron expands so as to occupy more space when it is cold than when it is melted or hot, would be to ignore observable results that occur in almost every casting made. When a pattern is constructed to make a casting from, it is made from $\frac{1}{20}$ to $\frac{1}{8}$ of an inch per foot larger than the casting is wanted. In an open sand mould for making a bar, ring, or plate casting, after being poured, the liquid iron begins to contract, and the contraction is steady and visible from the beginning to the end.

Again, if cast iron expands when cooling (as is stated by some authors), why is it that a heavy casting, after the mould is filled, requires so much feeding, taking from 200 to 400 pounds of melted iron to supply the shrinkage of the cooling iron? The satisfactory answering of these questions by those who claim that the law is the same for iron floating on liquid iron as it is in the case of ice floating on water, will, I think, be troublesome. There are a few experiments I intend making, and if the results of them give me any information on this subject, I will communicate it.

There is one thing that moulders know to be a fact, and that is, that melted iron when poured into a mould will raise a cope so as to run out, and perhaps make a bad casting, if the cope is not bolted, clamped, or weighted down sufficiently to resist the head pressure, and the momentum with which the raising iron comes up against the cope or covering.

The weight a cope requires on it to hold it down depends on three distinct things: the first of which is the height of head or pouring basin above the casting; the second, the velocity with which the iron comes up against the surface of the cope; and the third, the number of square inches in the surface of the cope.

In every mould these three conditions, in a greater or less degree, are present, and must be provided against. The momentum of the iron against the cope is the reason why a flask sometimes requires so much weight on the cope to hold it down. If it were not for this sudden pressure or blow, as it were, one-quarter of the weight generally used would be sufficient.

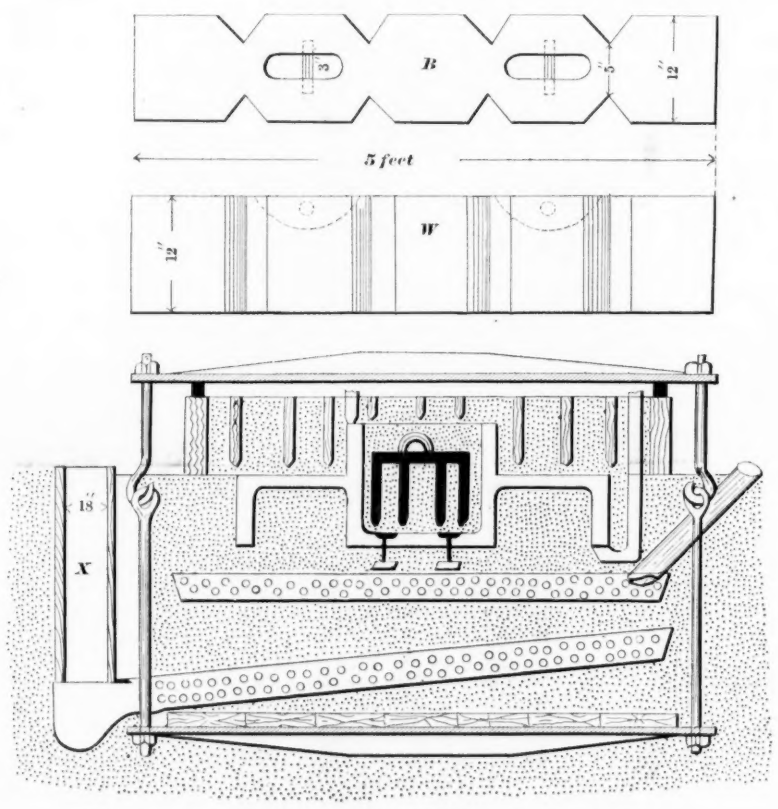
An idea of the effect of this momentum can be illustrated by the case of two railroad trains in collision and passing through each other, when if the power were applied slowly it would take a large number of locomotives to accomplish the same end.

For a moulder to say, as some do, that he has a standard rule whereby he can figure up the pressure on a cope, and hence the exact weight required to hold it down, to my view, is absurd. A standard rule for weighting down moulds would be a very good thing, could one be established, but I think that it is a safe assertion to make, that such a thing is impossible.

The various shapes and forms of castings and the position and height of runners, also whether a mould requires slow or fast pouring, etc., all require consideration and generally call for more weight on some parts of a mould than on other parts. The only safe plan in weighting a cope is not to be afraid to have plenty of weight, especially on that part of it where the runners are located. There are as many castings lost from the iron running out behind runners and gates as in any other way.

The cuts *B* and *W* show in plan and side view a cast iron weight of about one ton, made expressly for weighting down flasks. In a shop provided with a number of these, a cope can be reliably weighted, very readily. The V grooves are cast in the weight so that it can be broken and re-melted whenever desired.

The cut showing a cope bolted down represents a plan that some foundries have adopted to save labor in hoisting on and off weights, and to insure safety. It is almost impossible for a cope to raise so as to have run outs when bolted down in the manner shown.



WEIGHTS FOR FLASKS—PLAN OF MOULDING ON WET FLOOR.

One, or as many bolting-down floors as can be used in a shop, will save time in making castings that have great lifting surface on the copes.

To make a bolting-down floor, as shown, a hole is dug as deep as required, and bottom cast-iron binders placed solid and level.

On some floors that are wanted for long or large moulds, there can be as many binders as required, set a handy distance apart, which, for a common run of work, is about five feet. The binders should be about twelve feet long. On the top of these binders are bedded some heavy planks, and the sand shoveled in on them and rammed solid; then the bolting-down floor is ready for use.

The slanting coke or cinder bed, shown below the upper bed, is good for moulding castings on a wet or damp floor, which, however, is a very bad thing to be bothered with, as there is nothing that a moulder dreads worse than having to make a deep, heavy casting in a damp floor.

I have made castings by this plan where the lower part of the floor was nothing but mud—sometimes so wet that iron plates were laid down before the slanting coke-bed could be made.

By having two beds, as shown, the vents and heat from the melted iron when poured into a mould is taken off by the upper bed. If the heat should get to the lower bed so as to cause steam, there might be danger of scabbing or blowing were this lower bed the only one used; but, as shown, there is no danger. A deep wooden box *X* is set in, so that if any water collects below it can be bailed out.

When a floor is very damp, it is best to have two or three large holes dug out a safe distance from the mould, so as to drain any dampness from around and under it.

Floors could have plates full of small holes under them, every two feet apart, resting on the top of flat timbers. The timbers should rest on large flat plates on the mud bottom. The timbers between the upper and lower plates will leave an open channel under the mould, and with a good bed of coke or cinders laid on the plates, any water collected will pass through the holes in the plates to the large open channels below, and run into a well, from which it can be bailed or pumped out by hand or by a steam pump.

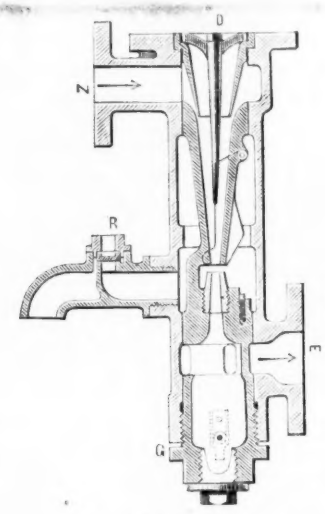
For over a year Wallman Bros., San Francisco, have been running the machinery in their shop by power taken from the cable of a street railway. The connection is made by means of a boxed underground shaft, running from under the floor of their workshop to the center of the street. At each extremity of this shaft is a single wheel, about 4 ft. in diameter. The one in the street is of iron, with a groove, in which the cable runs. A wooden wheel answers all purposes at the other end, and on this are belts connecting with the machinery. The usual rate is equal to one horse power, but it may be increased or diminished by means of a depression pulley, which bears the cable down upon the larger wheel. Two machines are at present run by this power, and it is described as most satisfactory, being smooth and reliable.

About 3,000 patents have already been issued for car couplers, and still the Master Car Builders' Association declares itself unable to select any one of them for a standard, but has referred the subject to another committee, who are charged with the tremendous job of "investigating the merits of the various couplers." This is about the course that has been pursued over and over by the Car Builders' Association for years, and the final result appears no nearer at hand than before. Meantime, the coupler inventors are multiplying, and the work of the committee grows in immensity.—*Railway Age.*

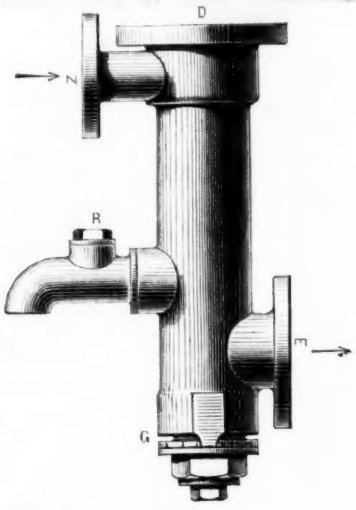
The success of wire cable propulsion for street railway cars on one line in Chicago, is said in six months to have been the killing of eight persons besides the injuring of many others. Rather an unsatisfactory beginning.

An Injector Worked by Exhaust Steam.

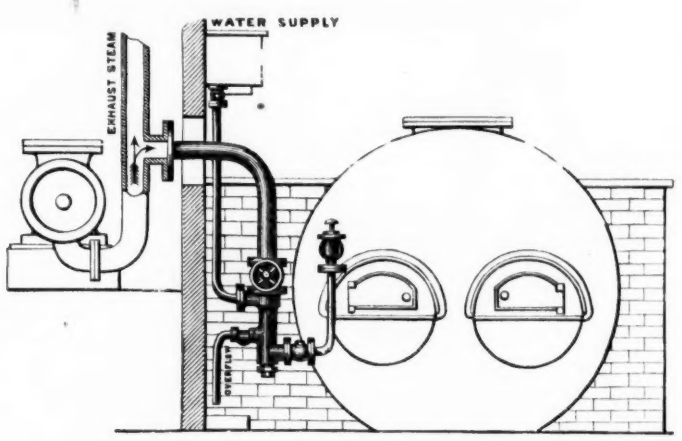
As an outcome of the various attempts to improve the construction and economical working of injectors, it is not surprising that some new and very interesting principles should be discovered. The injector here represented is the outgrowth of diligent and careful experiments. One engraving shows the external appearance of the injector occupying the same vertical position as it does in practice when attached to a steam engine. By the aid of the sectional view we will describe its parts and their operation. The working parts are inclosed within a case open at both ends and provided with a water branch *Z*, and a sealed overflow *R*. The combined steam and water pass through the delivery branch *E* to the boiler. The usual check valve is interposed between the injector and the boiler.



SECTION.



ELEVATION.



ENGINE AND BOILER WITH INJECTOR ATTACHED.

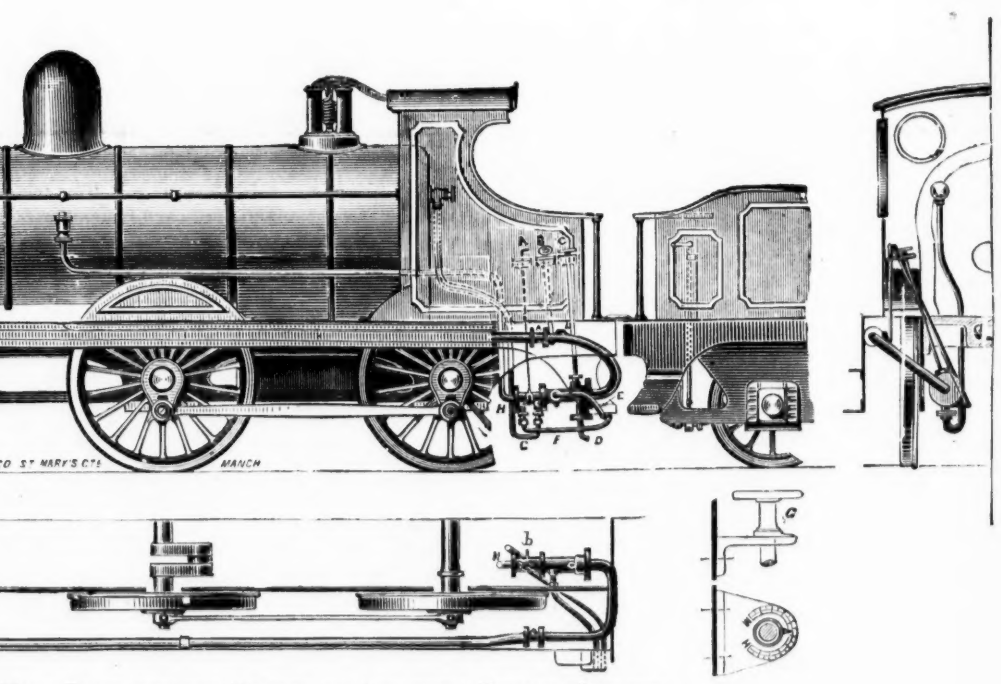
The reader will observe that this injector consists of three fixed jets or nozzles: a steam nozzle, a mixing nozzle and a receiving nozzle. The mixing nozzle consists of two parts. The fixed part being divided longitudinally for about two-thirds of its length and a short part hinged to it. The injector standing in a vertical position the loose part falls away from the fixed part when the injector is not working. The reason for this arrangement is substantially this: the large opening thus created permits the free entrance of a large body of water to condense the steam and insure the automatic starting and working of the injector. As soon as the injector starts, this hinged nozzle closes to its fixed size shown.

The exhaust steam pipe connects with the upper end *D* of the injector. The manner of connecting it with the exhaust pipe of the steam engine will be readily understood from the engraving of an engine and boiler. This injector will not draw water, but will work positively under a head of one foot. The water supply to the injector is regulated by the water regulator *G*, which is permanently set when the working conditions are once ascertained.

The exhaust steam pipe is connected with the exhaust pipe as near the cylinder of the engine as possible in order to utilize all the available heat of the exhaust steam. *No live steam from the boiler is used*, so this injector catches and utilizes the waste power of the engine as it is about to escape into the open air. This injector is of special value where exhaust pipes are of insufficient capacity to convey away the exhaust steam. Many instances of this kind may be found in our cities. If there is a back pressure in the exhaust pipe, as soon as the injector starts the back pressure will be greatly reduced, and in many cases a partial vacuum be produced, the injector acting as a jet condenser. To make this clearer we will refer to certain experiments, with their results, which we recently witnessed with this injector at the works of William Sellers & Co., Philadelphia, Pa., where they have a No. 6 exhaust steam injector in practical operation. The feed water showed a temperature of 64° when the exhaust steam valve was opened. The back pressure of steam in the exhaust pipe was half a pound per square inch. Steam first came out of the overflow, then water, after which the injector went to work forcing water at a temperature of 168° to 175°, against a boiler pressure of 65 pounds. Immediately upon the starting of the injector, the back pressure in the exhaust pipe disappeared, and the vacuum gauge indicated half an inch to one inch of vacuum in the pipe. By repeated trials it was found that the injector would break and start automatically with a vacuum of one inch in the exhaust pipe, forcing water against a boiler pressure of 68 pounds. Upon trial, it was found that the injector would work against a boiler pressure of 98 pounds before the stream broke. It then started automatically. For higher pressures, from 75 pounds up to 150 pounds per square inch, a second steam nozzle is introduced, and a very small quantity of live steam used from the boiler to help out with the exhaust. It will be understood that this injector at once takes the place of a heater and feed pump, the power to operate it costing nothing. It, moreover, increases the available power of the engine, to which it is attached by its action as a condenser in removing the back pressure. We noticed, at the trial alluded to, that the vacuum gauge several times indicated a vacuum of 4″ in the exhaust pipe before the stream broke. This experiment was repeated several times. Another and equally interesting experiment tried was to turn on the water at 8 pounds' pressure in the feed pipe, and upon opening the throttle the injector went to work reducing the pressure in the feed pipe to 2 pounds. The feed water was turned into a tank, having a head of one foot. The overflow from the tank and the injector were about equal. As soon as the injector started, the overflow from the tank ceased, proving that about double the quantity of water passed through the injector when working that could escape from the overflow when it was not working. The injector with which these experiments were tried was a No. 6, with a steam pipe 2½″ in diameter; overflow, 1¼″; delivery, 2¼″; feed water, 1¼″—throwing 600 gallons of water per hour.

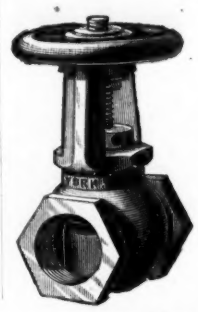
Where these injectors have been applied, as well as a saving of 11½ per cent. in coal over their usual apparatus.

These injectors are being introduced into this country by Schaffer & Budenberg, represented by W. Heuermann, 40 John street, New York.



ELEVATION AND HALF PLAN, SHOWING METHOD OF ATTACHING EXHAUST INJECTOR.

The York Globe Valve.



In our issue of June 17 we illustrated and described the York Globe Valve, made by Frey & Broomell of the Diamond Brass Works, York, Pa. Since then to meet possible objections to the inconvenience of packing the stem from the fact of its being partially inclosed by the yoke, the form of the yoke has been changed to that shown in the accompanying engraving. This change leaves a clear opening entirely through, so that the stem and stuffing box are quite accessible from either side, thus entirely doing away with any objection there might have been in this respect to the previous construction. At the same time the present construction insures the strain of the nut being exactly in a right line from the seat.

Steel for Boilers.

While in this country the use of steel for boilers seems to be increasing, we learn from French papers that in France engineers are generally reporting against the advisability of its employment for that purpose. It is argued that steel corrodes more rapidly than iron, and that it is liable to split and crack.

In summing up in regard to this subject, M. Cornut says: "For the present, steel plates do not afford sufficient guarantee for their being employed with safety in boiler construction, and it is advisable not to use them.

"I consider that the use of steel for this purpose requires a certain carefulness in manufacture, to which the greater portion of constructors seem disinclined to submit, whence arise the many disappointments which have followed the tests undertaken with regard to the use of this metal."

A new weekly paper called *Cheek* has made its appearance. The publisher should secure the Trustees of the Brooklyn Bridge as regular contributors.

Engineering understands that a Cologne firm has secured the concession for the establishment of telegraphic communications in China. All the officials will be Germans.

American and English Artisans.

A book has lately been published in England entitled, "An Engineer's Holiday, Notes of a Round Trip." The author has traveled largely in America and Europe and gives deductions from his observations. He found mechanics in the United States much better educated than those in England which, he attributes largely to differences in social condition. He says:

The American artisan is not sharply separated from the class above him either by dress or manners; it is only in the workshop that he wears clothes suitable to his employment; at home and in the streets his appearance is like that of his employer or any other citizen. This distinction may seem trivial to some people, but the case is one where trifles denote much, and the gap between the skilled artisans of the two countries is far wider than is indicated by differences in a coat. I once asked one of my own workmen, who had reappeared in the workshop when I thought he was in America, why he had come back. "Only to visit my friends," was the reply; "but I took a job to lessen expenses." "Do you earn better wages in the States than here?" "Well, I think about the same, for times are dull on the other side, but it costs me more to live in the States because I have a standing to keep up." "And is that why you are going back?" "Well, sir, that is the only reason; I can do, about as well in England, all things considered, as in America, but I am a respected member of society there, and here I am only a moulder.

No mechanic of eminence ever graduated from the grog-shop. It is the student and the thinker, not the joker and the drinker, who at first follows his trade and ultimately leads it.

There is no short cut to skill and proficiency in mechanical operations. A boy, no matter how apt and industrious he may be, cannot in six weeks acquire the knowledge and proficiency in doing work that has cost the journeyman six years of close application.

During the Paris Exposition of 1878 an engraving of the pavillion and large wooden model of the 80-ton steam hammer which were exhibited by the Cruesot Works (where the hammer is in use) was made and published. It is amusing now to see this same engraving embellishing the pages of several of our exchanges and referred to as a view of the hammer itself. The view of the model carries out the idea measurably well, but the surroundings are very peculiar for those of a veritable steam hammer.

The New York, West Shore and Buffalo railroad has ordered all contract work finished the first of November. Hundreds of additional men will be put to work between Newburgh and West Park. At present there are 35,000 laborers, nearly 800 civil engineers, 600 steam drills and 21 locomotives at work on the road, at a daily expense of $100,000.

New Traverse or Table Drill.

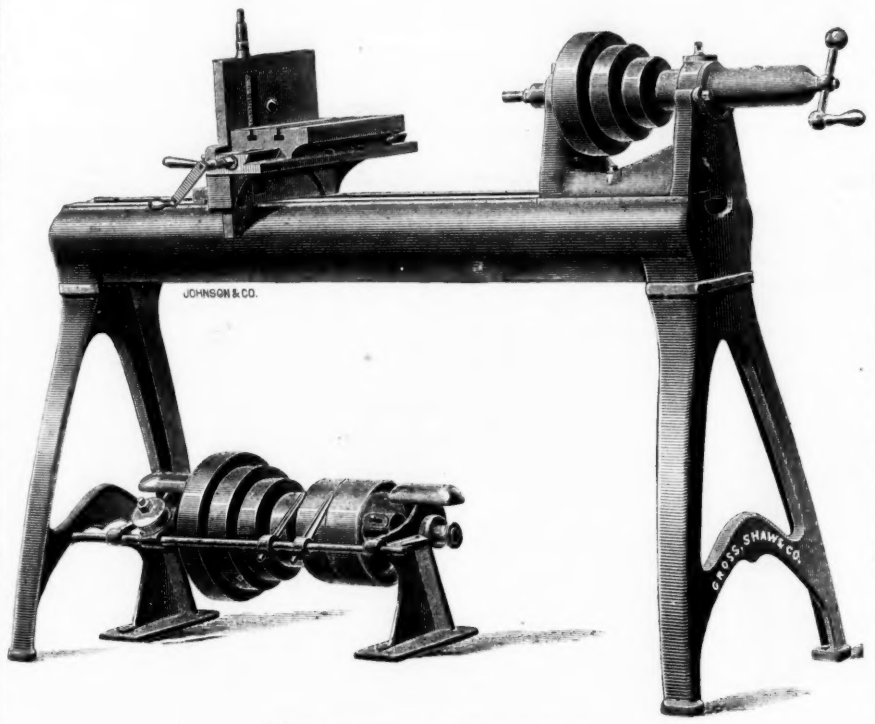
The traverse or table drill, as a small tool, is one which, although very popular some years since, for some reason has been neglected until within a short time, when its use has been revived, its usefulness being much increased by the application of those methods and devices which have so greatly enhanced the value of modern machine tools in general.

This tool is almost a universal machine in its adaptability to various kinds and classes of work.

Fitted with table centers, it will do such of the work done on a regular milling machine as fluting taps, reamers, rolls, &c., and work can be clamped to the platen, or held in a vise, when it becomes an excellent and stiff plain milling machine, and where a shop has no machine for the purpose it is a very convenient appliance for splining light shafts. For many kinds of light drilling it is superior to an ordinary drill lathe, as any number of holes can be drilled parallel in any part of the work. Such a tool is also very convenient for drilling holes for key-ways in the stub-ends of connecting rods, and with a boring bar guided by a bushing in the tail stock, small cylinders, boxes, &c., can be bored very accurately and rapidly.

A traverse drill is not in any sense a special machine, its large range of usefulness adapting it as readily to the continually changing work of the repair shop as to the more steady demands of manufacturing.

The machine shown in the accompanying engraving is manufactured by Gross, Shaw & Co., of Auburn, Maine, and is especially adapted to general use.



NEW TRAVERSE OR TABLE DRILL.

The spindle of hard steel is $1\frac{3}{4}$" diameter with a traverse or feed of $5\frac{3}{4}$". The boxes are cast iron. The center is $1\frac{3}{8}$ in. diameter at the large end and 6 in. long, with a taper of $\frac{1}{2}$ in. to 1 ft.

The cone is $2\frac{1}{8}$" face, with four changes for a 2" belt, and the change from fastest to slowest speed is in the ratio of 9 to 1. It is also made when desired with a three-change cone for $2\frac{1}{2}$ in. belt.

The bed has flat top shears with large bearing surfaces, and the sides are tied together by girts, spaced every 12".

The tail stock is heavy and rigid, with a broad bearing on the bed. The platen falls 4 in. below the center of the spindle when at its lowest point, and will rise 3 inches above the spindle, for convenience in operating on overhanging work.

The platen measures $7\frac{1}{4}$" × 12", and has a cross traverse of 14 inches. It has two T slots milled to standard size from solid metal, and truly parallel to the front of table.

All flat surfaces are scraped to surface plate so far as is practicable. Duplication of parts is secured as far as possible by standard gauges and special tools. All bolts, screws, and nuts are case hardened, and the feed screws are of steel and work in composition nuts.

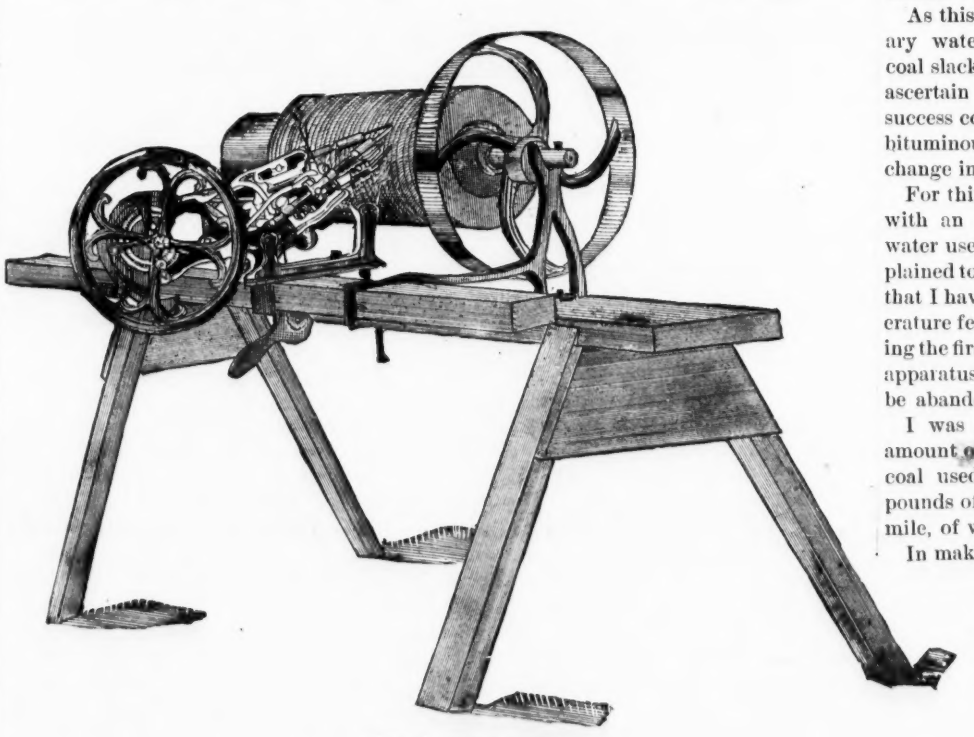
The countershaft has 8" tight and loose pulley for $2\frac{1}{2}$ inch belt. The loose pulley has a hub 6" long, and is $\frac{1}{8}$" smaller than the tight pulley.

The weight of the machine complete with 5 foot bed, is 650 pounds; with 4 foot bed, 625 pounds.

Gin Saw Filing Machine.

The accompanying engraving represents a machine for filing the saws of cotton gins, the invention of Thomas J. Barron, of Newnan, Ga.

The essential features of this machine consist of a base casting to which is fitted a sliding bed plate adapted to carry the operating mechanism. The filing is accomplished by two files held in rods fitted to be traversed in suitable bearings. The frame upon which these bearings are mounted is pivoted to uprights near one end of the bed plate, while near the other or inner end are two slotted uprights between which an arm of the frame is moved to set the frame at any inclination, where it is securely clamped. This permits the rods, and with them the files, to be set at any angle to suit different sizes of saws or inclination of teeth.



GIN SAW SHARPENER.

The files are reciprocated by means of suitable connections to the driving shaft, the manner of connecting being such that one moves in advance of the other, and that both receive an oscillatory motion, the extent of which can be regulated, and the object of which is to sharpen the edges of the teeth.

The feed of the teeth is automatically accomplished, the files being moved out of the way by suitable mechanism to permit the advance of a tooth. Suitably arranged springs press the files to the saw.

Experiments with a Baldwin Consolidation Engine having the Wooten Fire Box.

The following report of a locomotive test was presented at the late convention of the Railway Master Mechanics' Association:

Mr. President and Gentlemen of the American Railway Master Mechanics' Association:

The year that has just passed has been such a busy one for me and has added such an increase to my duties, that I have been totally unable to give my attention to the making of any experiments or locomotive tests whatsoever, but in order to add my quota towards keeping the subject before the association, I propose to give you a short account of my experience with a Baldwin consolidation engine having the Wooten fire box, in the burning of Illinois bituminous coal.

This engine was put to work on the Illinois division of the Wabash Railway in the latter part of the year 1880, and in December of that year and January of 1881, I made a short series of experiments with it, the results of which I propose to give you, with the hope that they may prove of value to some of the members present, and not be lacking in interest to others.

This engine was originally built for the Reading road by the Baldwin Locomotive Works, but for some reason remained on the hands of the Baldwin people, from whom it was purchased by our company.

It has 20" by 24" cylinders and possesses the regular Wooten fire box, the dimensions of which are as follows: length, 10 feet; width, 8 feet, inside, with a combustion chamber 4 feet in length.

As this engine came fitted up with stationary water grates, for burning anthracite coal slack, I deemed it a fine opportunity to ascertain by actual experiment whether any success could be met with in burning Illinois bituminous lump coal, before making any change in the grate arrangement.

For this purpose I fitted the engine up with an arrangement for registering the water used, similar to the one previously explained to the association in other experiments that I have made, but unfortunately the temperature fell to the lowest point of the year during the first trip and the formation of ice in the apparatus nullified its use, so that it had to be abandoned.

I was therefore unable to ascertain the amount of water evaporated per pound of coal used, and can only furnish you the pounds of coal consumed per loaded car per mile, of which a careful record was kept.

In making the experiment I had the engine make two round trips between Springfield and Danville, a distance of 113 miles, and two round trips between Decatur and Danville a distance of 74 miles, and will give you in as few words as possible a summary of the results obtained.

Performance of a Baldwin consolidation engine with Wooten fire box, in making two round trips between Springfield and Danville and two round trips between Decatur and Danville on Dec. 28th, 30th and 31st, 1880, and Jan. 1st, 4th, 6th, 7th and 8th, 1881.

State of weather stormy and cold, with snow, and the thermometer ranging from 20 degrees above to 18 degrees below zero. Ruling grade 40 feet per mile each way.

Total miles run by engine.....752 miles.
Coal consumed..... .....170,000 lbs.

Loaded car mileage..... 27,433 miles.
Empty car mileage.....3,803 "
Total loaded car mileage .....29,716 "
(Rating five empty cars as three loads.)
Average train (loaded and empty)..41.5 cars.
Average train, estimated loaded...38.2 "
Miles run to one ton of coal.....8.85 miles.
Pounds of coal per loaded car mile, 5.7 pounds.

As you will observe, the pounds of coal consumed per loaded car mile is exceedingly heavy; but, when we take into consideration the heavy snows and stormy condition of the atmosphere, it compares very favorably with the general average of our other engines, most of which are the regular 16 in. by 24 in. eight-wheel type, as the following table will show:

Pounds of coal consumed per loaded freight car mile during the following years and months:

January.....		...4.21	pounds.
December, 1879.....		...3.92	"
January,	1880	...3.24	"
December,	1880	...5.70	"
January,	1881	....5 20	"
December,	1881	....5.30	"

As a result of the foregoing experiment, I found that no difficulty was experienced in burning the Illinois bituminous coal in this class of engine with stationary grates, when fired in the usual way, one fireman being able to manage the fire while running with as much ease and freedom as he could on any of our other engines, the boiler making steam freely and in abundant quantity to do all the work required.

The chief difficulty we experienced in managing the fire was due to the necessity of drawing the clinkers from the coal through the fire doors when cleaning the fire, which had to be done every thirty or forty miles while running, and at the terminus of each trip. This difficulty, however, is due to the use of stationary grates, and could easily be remedied.

As to the capacity of the engine, we found that coming west from Danville sixty loaded cars was the maximum train this engine could handle, on account of the water capacity of the tank being small for the distance between the water stations, the tank holding 4,000 gallons, which clearly indicated the enormous evaporative capacity of the boiler.

On one of the trips the engine took fifty-five loads over Cerro Gordo and Philo grades, forty feet to the mile, cut back to sixteen inches; and this train could undoubtedly have been started from a dead stop on either one of these grades.

During the experiment the business on the road was such that we could not obtain cars enough to load the engine up to its full capacity, which will account for the low average train. On one of the trips, however, the engine hauled ninety-one loaded and empty cars—equivalent to sixty loads—and could have hauled more had the capacity of the tank been sufficient to hold water enough to make the water stations.

On all of the runs the engine made good average train freight time, which with us is seventeen miles per hour, did not cause any delay to other trains, and fully kept up the train despatchers' arrangements and calculations.

Considering the very low temperature, ranging from twenty degrees above to eighteen below zero, and the very stormy state of the weather during a part of the time, accompanied with a driving snow-storm, I think the engine performed remarkably well and fully demonstrated that Illinois coal could be used in the present shape and condition of the fire-box.

Having placed before you the facts concerning the working of this engine, while under my supervision, I have a few remarks to make concerning the general construction of the boiler and fire-box itself.

From my observations of this style of boiler, I am led to believe that it would not prove successful in our service in burning bituminous coal, from the fact that, owing to the peculiar shape of the fire-box and the general construction of the boiler itself, it would unquestionably give a great deal of trouble after a few years usage, in the shape of constant attention and repairs.

In fact, during the short time in which the experiments were being made, it was necessary for us to remove the jacket immediately over the firebox shell twice, in order to caulk the seams which began to leak so badly as to absolutely require its being done.

The flues also were a continued source of trouble, owing to their leaking very badly, which I account for by the necessity of opening the damper in the smoke-box door, in order to check the natural draught when the engine was standing still, and at the same time steaming too freely.

The allowing cold air to enter the smoke-box, in my opinion, causes a sudden cooling and contraction that is very disastrous to the life of the flues.

Owing to the extra large heating surface, the steaming capacity of the boiler is more than sufficient to supply all the steam that would be required under any circumstances, and as far as this quality is concerned the boiler may be considered as being good.

The irregular shape of the boiler, as a whole, however, in my opinion, renders it liable to excessive straining, though its liability of being subjected to extremes in expansion and contraction, which in a comparatively short time would necessitate constant attention and repairs, and the increased cost of caring for this kind of boiler, would not be compensated for by the benefits derived from the extra good steaming qualities. In general construction and arrangement of the machinery, the engine was good, and gave no trouble whatsoever.

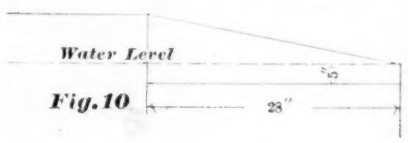


Fig. 10

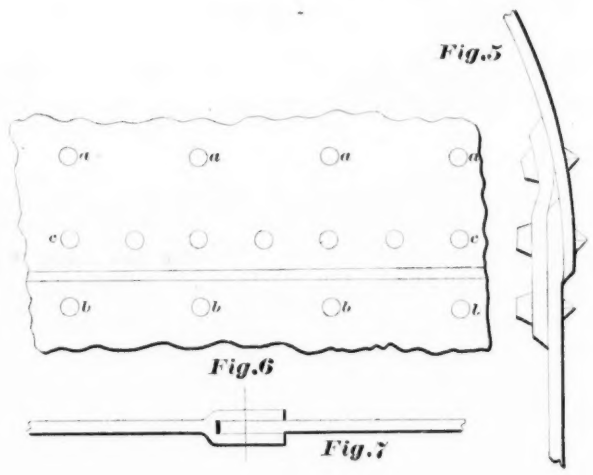


Fig. 5

Fig. 6

Fig. 7

In conclusion, I will say that, in my opinion, this class of engine, the Consolidation, is the proper engine for through freight service, in an economical point of view, owing to the capacity and traction of the engine being so great as to largely increase the size of the train hauled, and thereby diminishing the train service and expense.

JACOB JOHANN.

DISCUSSION:

Stenographically reported for the AMERICAN MACHINIST.

(Applying to Mr. Johann's and also to Mr. Well's report, published in our last issue.)

THE PRESIDENT.—I for one must say that I unhesitatingly object to bringing the lap on top of the boiler. The only advantage evidently is to get rid of one seam. It seems to me the disadvantages of having the seam on the top of the boiler and then cutting out through that seam and attaching a dome would more than counterbalance any supposed advantage gained. The difficulty of fastening a dome there and getting tight work must be great. Then the strains tending to rip open the boiler must necessarily be concentrated at that seam to a great extent. It is the disc of the half circle, and this being on the top, the strain there must be enormous; and it seems to me if our practice was carried out there, it would be very much stronger.

MR. SEDGLEY.—During the past three or four years we have made quite a number of boilers, the side sheets coming up on top as represented in the sketch, only we put a seam through instead of making a butt joint, and slotted the seam. It was for a class of engines where the dome went through the cylinder part of the boiler, and I presume that that is the English practice. You are well aware that with the majority of their engines the dome is on the cylinder part of the boiler, and I believe it is decidedly preferable to putting the seam on the side of the fire-box. There is in that part of the boiler more expansion and contraction, because it is not perhaps so well stayed. The circle is not as perfect there, perhaps, as it would be upon the top of the boiler, and my preference is decidedly for making the outside sheets of the fire-box two sheets instead of three. I should rather make it one. I see no good reason for not making our boilers in that way. We save one seam, and it is less work to make it in that way, and I believe it is decidedly preferable if we do not put the dome over the fire-box, and if we do, I see no objection to making it so even then.

THE PRESIDENT.—I would say, gentlemen, (referring to the drawing Fig. 3), that would indicate that the dome is placed near the back end of the boiler. I take it, the drawing at *E* represents the back head, the dome being placed forward about as we place it in our practice. That must necessarily bring that dome right over this seam.

It seems to me it must be very difficult to fit that reinforcing plate (Fig. 4, referring to sketch) around there, with the seam butt-jointed and welted each side, and get a good job. It must be very expensively or poorly done. I take it, the shape of that reinforcing plate is to run out and receive the rivets through that welt front and back. I can see no other object for it than to reinforce the seam running longitudinally on top of the boiler. Now, if that plate was solid; if there was no seam there to weaken the plate that certainly would be unnecessary. I do not mean to be understood as advocating the idea of running longitudinal seams each side down where they would interfere with the stay-bolts, but I do believe that a plate on the top running down sufficiently to get the dome on, a solid plate of iron is preferable to bringing the plates up and riveting them on the top and then cutting that out through the seam and riveting on the dome.

MR SEDGLEY.—My understanding is that the reinforcing plate forms the welt for the seam. I see no reason why it should not.

MR. JOHANN.—I think (referring to sketch) that that is a reasonably good construction for stiffening the crown of the dome. In the first place, I wish to say that I am beginning to get pretty well converted towards abandoning the idea of lapping our sheets.

I think that that is not as good as it might be. The circle being irregular, the natural tendency is to make this ring so—naturally by working on that sheet, in expansion and contraction. That is one reason why our joints sometimes groove so very deeply, in my opinion; and some of our explosions are largely due to the same cause. Now there is no objection to putting the dome right over the fire-box. I would throw the additional sheet over the outside and bring it down pretty well towards the center of the circumference, butting the outside sheet and branching it up to take the dome. That would give you full metal all around there, and it would very materially stiffen the back of your shell. Now the general impression would be, what is the use of putting so much metal there? Now that additional metal does not amount to a great deal in weight, and it amounts to considerable in strengthening the back of your boiler, in every way making a more perfect job. I have two boilers, one of which I constructed by bringing the sheets up and butting them in the center, and putting just an ordinary welt piece about 12 inches, over there to secure the joint. With the next one I built, I brought the sheets up and bolted them in the center, and it made a job so decidely better that I continued to construct in the same way, especially with those boilers that have been under discussion before the association. It does not cost much money. It makes but very little more labor, and that little additional weight is more beneficial than otherwise. It gives you that much more weight on the drivers, but it stiffens the boilers considerably. I think that I shall bring it out more largely. I think that it would make a decidedly better boiler. I think that when it is well developed to operate on, that it can be done fully as cheaply as by the other way, and I think that it will very materially lengthen the life of the boiler. I find that boilers that I have had in my hands, after they get a little old, will always be more or less grooved on the seams. I believe that is the original starting point of grooving, from the natural working of the sheet in trying to work itself into a perfect circle. When it once starts, it gets along very rapidly. If not discovered in time, it will eventuate in the explosion of the boiler. There may be some way of making it more perfect; but that is a very good way so far as I can see it. I am decidedly in favor of developing construction on this principle. But to overcome the objection that you make in particular and which, I apprehend, a very large proportion of the members would also make, that may be overcome very nicely by making those sheets come up to the center, butting them and throwing an outside sheet over, which gives you an entirely smooth surface on the top that you can branch up and hang your dome to.

MR. DURGIN.—I would like to ask the gentleman what experience he had that led him to adopt this double sheet. I understand he built one boiler first without it, the next one he built with it. I would like to know what led him to adopt it.

MR. JOHANN.—What led me to adopt that special boiler, which has been illustrated here before the association, was in order to get more thread. I could not get thread enough to hold the stay-bolt; and that is the reason I threw that sheet down there.

After it was on, the whole thing was so substantial that I admired it, and I believe that it is a material benefit to the boiler. We have not had a particle of trouble with those boilers. They have not leaked nor simmered in any way. Both those boilers have made 135,000 miles. One carries 140 lbs., and the other 150 lbs., right along, hauling passenger trains of not less than nine cars, from that to twelve.

MR. DURGIN—Would it not have been equally well to make it a thick sheet in the first place?

MR. JOHANN.—It would have been equally, except to assist the lap. The thick sheet will still have to do the work and reinforce the lap. I am beginning to butt my joints, and of course I have to put welts on there in some way or other to hold them. I do not state that I consider it is so very great an advantage, except that it does not cost any more than the other way, and I think it is a better job From the performance of the boiler, I am so entirely satisfied with it that I shall continue it.

MR. DURGIN.—Has the first boiler you built given you any trouble?

MR. JOHANN.—No, sir.

MR. DURGIN.—That one, then, so far as you know from your experience, is as good as the other?

MR. JOHANN.—Yes, sir.

MR. FRY.—It is interesting to know that the butt joint, where it has been tried, either with the covering strip, as illustrated in Fig. 2, or with the wide covering strip, which Mr. Johann has used in his boiler, which has been so much admired, has proved successful, giving satisfaction.

Now, in regard to putting on the dome, it sometimes happens that it is very difficult to arrange a dome on the barrel of the boiler without throwing the seam down into the water space. I asked a question yesterday to ascertain if any of the members had experience with the seams of the barrel, a short distance below the water space. It sometimes happens, in designing a locomotive, that you have a very large dome—a 28 or 30 inch dome—and for some reason you do not like to get the seam close to the foot of the dome, and to get it just where you want it, it gets just down into the water space, and many engineers are under the impression that the seam is just as safe from curving if it is six inches below the top of the water space as if it is within the steam space. If it should be found to be subject to grooving, even a few inches below the water surface, you would then be obliged to put the seam up on top. You would be afraid to put the seam low down into the water, because it would groove; and if it is established that it is equally dangerous to put it a little below the water, you could not put the seam on the lap of the dome, you are then obliged to bring the seam away up on top of the barrel; and the objections which our president thinks hold good against placing the dome on top of the seam are sound, it is very difficult to design a boiler that will be satisfactory. But if it is only a fancy, if there is no objection, if it is perfectly safe to put the dome right on top of the seam, it is a very valuable fact for us to know; for it will very often help us to get up a new design. It will be very interesting to know the best way to do it. The suggestion that Mr. Forney makes of putting on that heavy piece necessitates also keeping the hole for the dome the same size as the dome. Many engineers have made a large dome with a small hole, or have materially reduced the size of the hole, and it will be interesting to note whether there is any

experience in that form of construction, because you might get by that means a very much easier way of strengthening your dome. The dome must be brought down and flanged, and riveted to the boiler; the barrel sheet carried forward, and a small hole made in it, and, if necessary, a covering strip around that hole. A strengthening ring, such as Mr. Johann uses, could be run around the hole. That would seem to me to be a very much cheaper and easier form of putting on our domes than that suggested by Mr. Forney.

MR. WILDER.—Mr. Hayes says that he puts in his liner covering one-third of the circumference of the boiler, and he has no trouble whatever in furrowing above that point—I mean above the point which the liner covers,—and from that experience there would seem to be no objection to putting the seam down below the water-line, providing that you did not go below the center of the boiler, so that the sediment which settles from the water would settle upon the joint. As long as the joint was above the center of the diameter all the sediment would drop away from it.

MR. JOHANN.—As a matter of opinion I do not think that it is the sediment; of course I have not any facts to substantiate it. I do not think that the sediment has so much to do with the furrowing as the irregular shape causing the expansion and contraction. I know, in the case of a boiler explosion that came under my notice, that unquestionably the boiler let go just at the horizontal seam. I should judge, as near as I can remember now, that it was three inches, probably, below the water-line. On investigation it showed that the sheets were furrowed, and a very large portion of it did not have but about $\frac{1}{16}$" of solid metal, and from all indications, as near as any man's judgment would infer, that was the source of the giving way of the boiler, and that was the seam that was not more than three inches below the water-line, above the center.

MR. WILDER.—I only drew my conclusions from the argument made by Mr. Hayes yesterday, and his statement with regard to what he found when he put his liner in, which covers only one-third of the circumference of the boiler. That would seem to be testimony that the liner does not entirely protect the seam from furrowing.

(In answer to questions Mr. Johann said the wasting away of the sheets was on the inside of the boiler, and that he had not known the furrowing to take place above the water-line.)

MR. SEDGLEY.—I would ask Mr. Johann if in the arrangement referred to he examined the seam to know if it was uniform—if there was not some irregularity in the form of the boiler at that point. Several years ago we had a case, I think, very much like what Mr. Johann speaks of. To start with, it is very difficult to get rolls that will roll a sheet clear to the end, and therefore the circle is irregular at the end of the sheet, and boiler-makers generally undertake to form it up with sledges. Every time the boiler pressure comes to it there is a strain, and there is a tendency for the sheet to give way on the inside. This boiler that I refer to gave way for some five or six feet, but there were no symptoms of furrowing. In my experience I have never found any furrowing above the center of the boiler. I should be very glad to know, if such is the case, if it takes place two or three inches below the water line; in fact, I do not welt my cross-seams if I can get them up within four inches of the water-line.

MR. JOHANN.—In answer to Mr. Sedgley, I would say it was utterly impossible to form any opinion of the condition of the sheet, for it was twisted out of all shape; but it was not simply a crack, it was a decided furrow; that was unquestionable—and on the internal surface it was furrowed out for the space of $\frac{3}{8}$ of an inch, and chamfered down in that way till it left about $\frac{1}{16}$" of solid metal.

MR. DURGIN.—I would like to ask these gentlemen who are familiar with this furrowing, if they calked their boilers on the inside, if they ever notice any difference whether calked or not, and if calked, how calked, or whether that starts this furrowing in the first place?

MR. JOHANN.—There is some doubt in my mind as to whether a great deal of the furrowing is not started from injudicious calking. I am not aware of any special instance where I have noticed that it would be from calking, but I am constantly quarreling with my boiler-maker on the calking question, so as to avoid that if possible. I have no doubt the trouble is very largely due to injudicious calking. On the other hand, this matter of vibration has a very large influence in the matter.

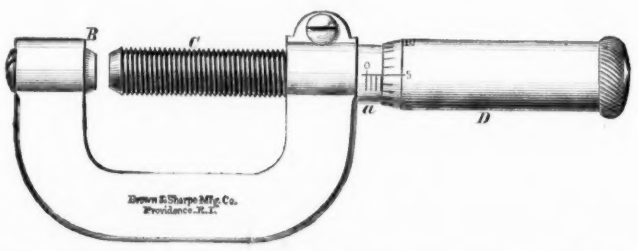
MR. HAYES.—Why does not that take place above the water-line, if it is due to that entirely?

MR. FRY.—I no not think that the furrowing is to be attributed to the calking to any considerable extent. The furrowing of boilers is almost entirely confined to our Western friends and others who have very bad water. There is scarcely any furrowing boilers where the water is good, and so far as we have obtained evidence from the members present, there is no furrowing above the water line and not very much just below it.

I think it is very evident to all of us that the workmanship has not very much to do with it.

It is very important that we should know where it is safe to place our seams, and if we can get any further evidence substantiating Mr. Johann's experience that furrows do sometimes take place even a short distance below the water line, we shall have a good warning then to keep our seams away up in the steam space.

MR. SETCHEL.—A few years ago the road with which I was connected bought five engines from a locomotive works which had a long connection sheet (see Fig. 10) 28" in length, leaving a flat surface without any cross-stays whatever, probably about 5 or 6 inches below the water line. After one of the engines had been running about three months it exploded, blowing this sheet out. A close examination was made, and we found that it had worked itself off about in that shape (illustrating) grooving right above the seam. We then took in one of the other engines that happened to be in the round-house, stripped off the jacket, fired up the engine and the steam was visibly oozing out, and we immediately went to work and changed them all, putting in a short sheet, and we found that all those engines had commenced grooving at the top of a lap so that they were dangerous to run, although in service only about three months. I am satisfied that the irregular shape above the water line will, by that tendency to work itself round, groove or break off; but I believe that where the irregular shape is below the water line, then it has the chemical as well as mechanical force working on it. Every time the expansion and the contraction takes place the chemical work is going on, and it grooves much quicker below the water line than it does above, but I have never yet seen, when the surfaces were properly stayed and the boiler a true circle, any grooving above the water line.



STANDARD MEASURING INSTRUMENT ADOPTED BY THE MASTER MECHANICS' ASSOCIATION.

I think this pitting is very much more mysterious than the working off of the sheets at the seams. I do not think that there is anything mysterious about that at all. The tendency of the boiler is to draw in a circle, and if there is the least working of the boiler, it is only just a question of time how many times that can come and go before it works off Sometimes you find pits as large as a dime in the bottom of a tank or the bottom of a boiler scattered all over the surface—in some places thick and in others scattering—and can give no cause for it; sometimes I have seen a hole, just a single one, as large as a dime, extend clear through the sheet, and all around it the sheet would be of the original thickness.

MR. WILDER.—Some years ago we had a number of engines built with a long gusset similar to this seam, and we had very much the same trouble with them, only we were not unfortunate enough to have any of them explode; and by putting on a welt over all these seams we never had any trouble with those engines. They ran twelve years after that. But I thought at the time, and still think, that the position of the grain of the iron had a great deal to do with the touble—that the grain ran the wrong way—or, in other words, it ran longitudinally and with the seam.

With regard to pitting, have any members who are troubled with pitting had an analysis made of the scale or substance that immediately surrounds the hole or pit and that which is a little further away, where there is no pitting, on the same sheet, to see if there is some different chemical substance that deposits itself right over the hole having a tendency to combine with the iron and wear it away?

MR HAYES.—I have attributed this pitting to defects in the metal when it is first rolled, from this fact: I some time ago bought some steel, as smooth and as nice as any steel that I had ever seen, and allowed it to remain out of doors; there came a heavy shower upon it, and it lay there two or three days. When we put that steel in the shop and put it through the rolls, there were cinders or something else in the steel when it was rolled, and in rolling the sheet after it came out of the rolls and was hammered a little, it looked just as though a man had come out of a spell of small-pox pitted all over; I have always attributed this pitting in the sheets, other than at the seams to this cause, viz.: a defect in the metal when it is first made, and the additional strain of the boiler perhaps loosens that and it gives this chemical action a chance to go to work and eat it out. I am pretty certain in my own mind that that is the cause, because some metal will do it a great deal more than others. We used to get some iron at the Wyandotte Mills below Detroit which was very much subject to pitting, and I think that it is entirely owing to the defects in the metal when it is made.

MR. SEDGLEY.—We never have pitting upon the ordinary seams around our fireboxes. I have never known a case where that took place to any extent. The same boilers with the seams below the water line are the ones we suffered the most from. I would like to ask if any gentleman here has had any trouble with the ordinary seams in their boilers, from pitting?

MR. SETCHEL.—Mr. Sedgley has made an objection, as I anticipated, to Mr. Hayes' theory that pitting never occurs above the water line. Now if it is in the sheets, why doesn't it occur in the steam space as much as below the water line, or in the perpendicular seam?

MR. WILDER.—One of the members suggests to me that if Mr. Johann's boiler exploded after three months, that the time was very short for a furrowing to take place, and we would like to know if a particular examination was made on the inside of the boiler to see if it was a furrow.

MR. HAYES.—We have had our inside sheets pitted some, but not to that extent on the cylinder part of the boiler, but almost invariably they pit some on the inside; but still I am strongly of the opinion that it is from the defects in the metal.

MR. ROSS.—We took three fire-boxes out last summer, and just above the ring for the entire distance around the fire-box they were grooved off half of the depth of the sheet. It looked to me as if it was from deposits just above the ring, and pitting and grooving the whole distance around the entire sheet on all three, We run through a very limy country. Our water is very limy.

MR. JOHANN.—I entirely agree with Mr. Hayes. I think it is imperfect material; I do not think there is much chemical action; I think it is imperfect rolling of the material. I think there are pits that do not show in the original shape, and after they get to work they gradually drop away and hence the pitting. I have not made any tests upon that; but I look at it in that way. Where we get our boiler material I keep constantly hammering at those people to be more careful in rolling their plates; and we do get better plates.

MR. J. D. HOLLISTER.—I think the most of this trouble grows out of the vibrations in the sheet. We have adopted the seam that I have tried to illustrate here (see Figs. 5 and 6), which represent a welted seam with three rows of rivets. This was adopted for the reason that we wanted to get a good calking joint; we also wanted the rivets comparatively close together. By putting them as at *c c*, the sheet is weakened right through the line of rivets. By putting the outside rows, *a a* and *b b*, of rivets twice the distance apart it strengthens the calking joint. The rivets being close, the welt underneath taking these outside rivets strengthens that joint and makes the seam as strong as the metal that lies there between those spaces; that is one reason. Another reason is, that we think the vibrations are disposed to concentrate as it were right along on the edge of the lap; these vibrations here, *a a*, have a chance of dying out as it were, the sheets not being held close together. Now another reason is the matter you spoke of yesterday—illustrated by an indirect pull. By making this lap this way we put the strain on the joint, something like a simple fork connection (see Fig. 7), giving a more direct pull; while we have no trouble with our water, we occasionally have sheets crack along the seams, and we think it is owing to the concentration of vibration.

A Frenchman engaged in lumbering in Austria has purchased from a Western manufacturer a set of machinery for a fully equipped mill of the American type; consisting of engine, belting, shafting, gang, edgers, etc. Two American engineers will accompany the machinery for the purpose of erecting it.

A Standard Wire Gauge Adopted.

At the recent Railway Master Mechanics' Convention at Niagara Falls, R. H. Briggs, Chairman of Committee on Standard Wire Gauge, made an interesting report, in which he says:

"After giving the matter my personal attention, and having received the expression of opinion of many of the larger manufacturers 'all over this country,' I have come to the conclusion that an 'American standard wire and sheet metal gauge is an actual necessity, and the sooner one is adopted the better for both the manufacturers and consumers. I find that manufacturers have on hand and in use different kinds of gauges, all of which are seemingly appreciated by them, not because of their particular merits, but simply for the want of better.

"All with whom I have communicated desire an improvement. I say, after making the subject a specialty, I am fully convinced that, for practical use, uniformity and accuracy, we have no such standard."

Mr. Briggs mentioned some correspondence with different manufacturers in reference to the subject. The following extract from a letter of Coleman Sellers, of Philadelphia, tersely outlines the proper course to pursue:

"I think that plates should be rated by their thickness in inches and the decimal of an inch, conforming as far as possible to the existing division of the inch, by the binary division. Thus, $\frac{1}{2}$", $\frac{5}{8}$", $\frac{1}{4}$" plates answer the purpose of the trade and the purpose of calculated strength better than the expression of the thickness of the spaces in a gauge, which spaces must be translated into inches before they can be used in computations. When we get below $\frac{1}{16}$", it may be well to have some gauge; but even in this case I am inclined to favor the use of the small-plate gauge, with screw, made by Brown & Sharpe, and the expression of all thickness by the thousandth of an inch. I do not believe in this thing of a gauge founded on a French measure, because I hope the craze for that system is on the decrease, and that in America we will never adopt the French system. I have expressed my views on this matter in a paper read before our Association of Mechanical Engineers some years ago. I refer you to it for what I think, and I now supplement that paper by one which I read before the American Society of Mechanical Engineers last year."

An extract from Miller, Metcalf & Parkin's "Treatise on Gauges" (as it appeared in our columns some months ago) was presented in the report. The difficulties involved by reliance upon notched and numbered gauges were graphically portrayed in the extract, and the safe and simple remedy for the whole explained, to wit: the adoption of the micrometer gauge. The extract closes as follows regarding this little instrument:

"They are very simple, so that any boy of ordinary intelligence can be brought to use one in a very few minutes. They have very easy arrangements for readjustment when worn, and even when worn considerably they can be used accurately, without adjustment, by making allowance for the error in reading at the zero line. We find that mechanics like to work to them, and that there is very little trouble to get sheet rolling done to within a thousandth of an inch on fine sizes."

Mr. Briggs reported the conclusion of the committee as follows:

"I most respectfully recommend for adoption the micrometer gauge, made by the Brown & Sharpe Manufacturing Company, Providence, R. I.: First, for accuracy in measurement; second, for ease of adjustment; and third, for its durability. It measures by the thousandth of an inch very accurately, is simple in construction; special sizes can be made suitable for tool work, when so required."

DISCUSSION:

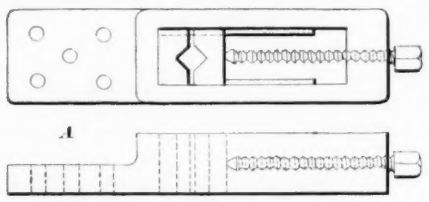
Stenographically reported for the AMERICAN MACHINIST.

MR. BRIGGS.—I was undoubtedly the most surprised man you ever saw when I found that in the United States we did not have any positive measurement by which metal workers could be so guided as to fill an order exactly when called upon. Every man whom I applied to confessed his inability to fill an order exactly. They all had a certain series of gauges that would measure to suit them, but nobody else. I assure you gentlemen, that this matter has given me a great deal of serious thought, and I tell you that you do need what I recommend—a standard American gauge. I hope that what I have done will meet with your approval.

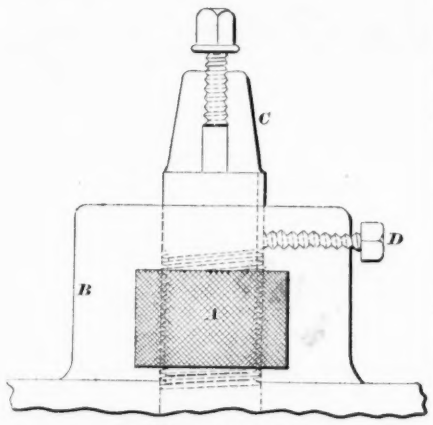
MR. FRY.—If I understand the recommendation right, it is simply this: That in specifying sheet or wire we state exactly what we want. If we want half an inch thick we say half an inch thick, and so on; and there is no room for doubt as to whether

we mean Birmingham wire gauge or Stubbs' wire gauge, or some other wire gauge. Unless some gentleman can show us that there are differences that cannot be measured, or that there is some insuperable objection to ordering metal in that way, the good sound common sense of the recommendation is such as I think will commend itself to us all.

MR. FLYNN.—We all know the difficulties that have existed for many years owing to the multiplicity of gauges that exist in this country. In some cases where we have ordered iron, and found when we received it that it was not right, the manufacturers have said, "We understood you wanted the Birmingham gauge;" and when we have come to compare it with the Birmingham gauge, we have found it was not right by that. In many cases the persons furnishing the iron suppose that you have not got the Birmingham gauge. I once gave a heavy order for all grades of iron to the Fillman Works in Tennessee. The iron came and none of it was correct, and there was about thirty-five hundred weight more metal in the iron than there would have been if it was right. I ordered it to the American Wire Gauge. Now I think it is essential that we adopt some gauge to be known as the American Standard Gauge. You can call it the American Micrometer Gauge, or give it the name of



DRILL-PRESS VISE



ELEVATING TOOL POST

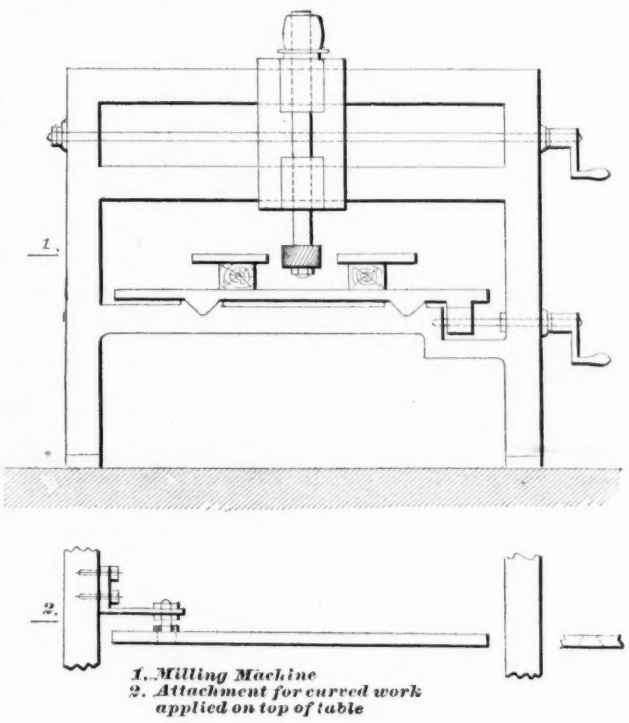
this Association; and whatever the gauge is, it ought to be well published to the American public, at least that that is the Standard Gauge of America. Because if you do not so publish it, that old system will still be in existence, and it is extremely necessary that we should get those engaged in the manufacture of sheet iron to recognize that as the standard gauge of this country. We will thus do away with the Stubbs Wire Gauge, the Birmingham Wire Gauge and all those gauges and adopt a system of measuring exactly the thickness you want the iron. The only thing I want to impress on the minds of the members of the Association is this: that such a course should be adopted as will make the gauge decided upon the standard gauge of the country.

MR. BRIGGS.—I will state for information that on the gauge is a little column upon which are divisions, and each division represents $\frac{1}{1000}$ of an inch, or $\frac{1}{40}$, as you may term it. On this standard is a little revolving cylinder, on the bottom of which are divisions. You will find twenty-five divisions on that little cylinder. You turn that one division, and that lifts the screw exactly the one-thousandth part of an inch. A person having a very good eye can turn up a half of that and get a most accurate measurement of one two-thousandth of an inch, and so on less than that. It is as simple as can be; you cannot make a mistake. You have a little binding screw there which you can set to as fine a gauge as you want to work to After a certain amount of wear has taken place, the mode of adjustment is to bring the zero mark around to this line (indicating), and it is just as good after ten years' ordinary use as it was the day you got it.

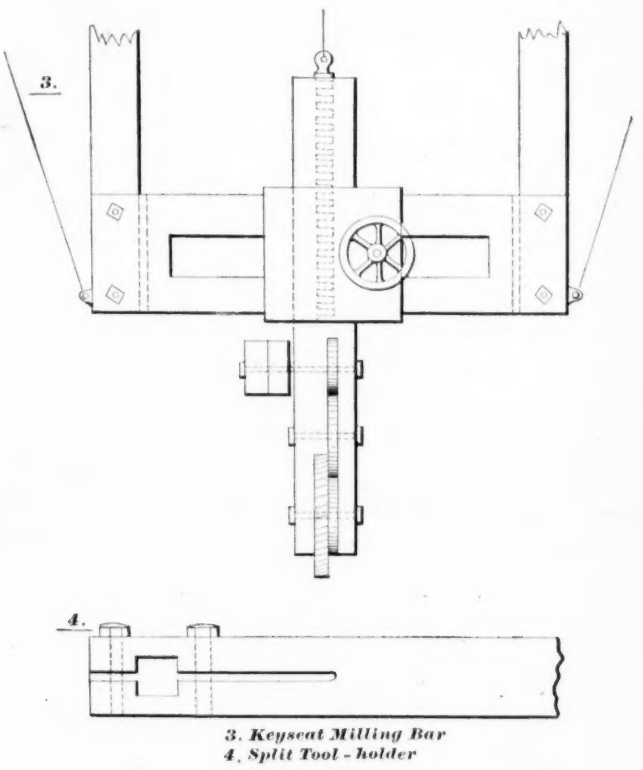
MR. FLYNN.—If the members of the association think that this is one not suitable, why let another one be suggested. When we reflect upon the number of years we have been engaged in mechanical pursuits in this country, and think that we have had no gauge for use all over the country, it is something almost astonishing. A great many men in sending out orders simply say "wire gauge;" naturally the rolling-mill men will suppose it is the Birmingham gauge, and it comes so. The beauty of this instrument, as I understand it, is that you just order your iron to the thickness you want it. If you want one-thirty-second of an inch, or one sixty-fourth of an inch, you order it so; you do not order number 14 wire gauge, or number 13 wire gauge.

MR. FRY.—I suppose if we decide to order iron by measurement it would be at the option of the rolling mill to take any measuring machine they liked. If we ordered iron a thousandth of an inch thick, it would make no difference whether he measured it by a two-foot rule or an ordinary gauge, if he could prove he gave us iron a thousandth of an inch thick. But if we know there is an accurate instrument easily obtainable, and we order our iron by measurement, we can then, in case any misunderstandings spring up, easily settle them, and it will be so much the better for the whole country.

PROF. SMITH (Washington University, St. Louis).—I have had experience in ordering several thousand tons of plate iron. I soon learned that I had to order it by specifying the weight per square foot, telling them that I would not pay for any more. With regard to this, it is simply an accurate machine for



1. Milling Machine
2. Attachment for curved work applied on top of table



3. Keyseat Milling Bar
4. Split Tool-holder

getting the standard measure of the United States. It is not a gauge in the sense in which the word is applied to the Birmingham wire gauge.

MR. JOHANN.—I understand that what we want is a standard gauge. This, so far as I can see, is merely a measuring machine. By the existing system, when you order anything, nobody knows what you want. I think we ought to determine on a given gauge, and this instrument can still be used to measure iron with. But I do not see that in adopting this we adopt any particular gauge. This measures anywhere from a fractional part of a thousandth to half an inch or more. I understand that what we want to get is such an instrument as the American gauge, or the Birmingham gauge, or the Stubbs' gauge. If we adopt one gauge of that description, the manufacturers will know what we want when we give an order. If, when you purchase any sheet metal, and have the suspicion that it is heavier or lighter than you ordered it, this instrument can be brought into play to test it. But I do not see that we will establish any gauge in adopting this. It is a measuring instrument, but not a gauge. What we want is to establish a gauge, and rule all the other gauges out. If we decide to do that, either one of those gauges will answer the purpose.

MR. BRIGGS.—I am afraid that our friend has not read my report. In that report are shown the differences in the same gauges all over the country. One man may have a gauge that he uses twice a week; another may have a gauge of the same kind that he uses fifty times a day. How are you to prove which of those gauges is the truer? The object is to have something that is positive, let it be called a gauge or a measure, or what you please. I tell you, gentlemen, that that is the only thing on the face of the earth—and I make the assertion advisedly—that can be relied upon as a positive measurement every time. I know that this Convention can honor itself by adopting that gauge, and I recommend it with the greatest confidence.

A MEMBER.—Only last week I was ordering some copper to place around some flues. I ordered sixteen copper, and it went into my gauge easily at eighteen. Mine was a comparatively new gauge, and theirs was a gauge which they had been using in the store for iron and copper and wire for fifteen or twenty years probably. They were both Stubbs' gauges. Probably the sizes between sixteen and eighteen were the ones that had been used the most.

MR. JOHANN.—In reply to Mr. Briggs, I do not dispute his argument in the least; but at the same time I fail to see how this will establish any particular gauge. What we want to do is to establish a gauge so that manufacturers will know what we want when we give an order.

MR. SETCHEL.—I do not understand Mr. Johann's argument. It seems to me that a gauge is simply for measurement. The trouble is that number 2 Stubbs' gauge is not number 2 Birmingham gauge. But a thousandth part of an inch is a thousandth part of an inch. Now, as I understand it, the steel manufacturers and the iron manufacturers have especially recommended in their letters to Mr. Briggs that that kind of a gauge be adopted. It seems to me that to adopt any particular gauge leaves the matter where it was before. The gauges may not be right, but the thousandth part of an inch, as I said, is the thousandth part of an inch; and if we say to a manufacturer that we want a piece of metal a thousandth part of an inch, it must come that way. We simply say we will adopt that as a unit of measurement and order by it, and that settles the matter for all time. I agree with Mr. Briggs that if this association does that and sticks to it, that it will cover itself with glory. There will be no getting around it on the part of manufacturers. We say to them "we want a sheet of iron of a certain thickness, measured by Sharp's gauge," and we do not care how they measure it; they can measure it by Stubbs' gauge if they like; but if it is not of the right measurement by Sharp's gauge we will not have it.

PROF. SMITH.—What I said before was not intended in any way to be a speech against this gauge or this measuring apparatus, because it is the only way in which you can get good work; but simply as to the meaning of the word gauge.

THE PRESIDENT.—I agree with Professor Smith thoroughly that this does not establish a gauge. At the same time, I believe, as Mr. Setchel does, that we had better establish this system of ordering iron, and insist that the iron be measured by some suitable instrument that is accurate. Now, here is an instrument which I find, on examination, is self-adjusting, practically. I inquire, How are you going to know when this gets worn? I find that the moment it wears in the slightest degree these graduations will not correspond until they are adjusted. I think, as Mr. Setchel has so eloquently said, that this association should adopt some system. It is not adopting a gauge, in one sense, in adopting this, but adopting a system of ordering plate. And the system that this committee has recommended is, I believe, the correct one.

MR. BRIGGS.—I do not want it to be understood that I would advise that this Association should dictate to the manufacturers of the United States that they shall use that as a gauge; not by any means. But I do want it understood that we will not accept any other measurements but that. They can use a Stubbs' gauge, or Standard American gauge, or anything that they choose, but it must conform to our check every time.

MR. JOHANN.—That is just the point I am making. I have no objection to changing the system of ordering, but we certainly do not establish any gauge when we establish this instrument to measure by. If you change the system of ordering, it lets us all out. It leaves Mr. Briggs right, and it leaves me right too.

THE PRESIDENT.—As far as I can see, both the gentlemen agree, except in the matter of terms. I agree with Mr. Johann, that this makes no change of gauge. I do believe in changing this system of measurements, and here is an instrument that makes that possible.

MR. FRY.—I should like to propose that it be the sense of the Association to abolish the system of ordering by gauges, and adopt the system of ordering by measurement, in plate, wire and other articles that we have been accustomed to use gauges for heretofore.

The recommendation of the committee was adopted.

LETTERS FROM PRACTICAL MEN.

Elevating Tool Post—Drill Press Vise, Milling Machine—Keyseat Milling Machine with Appliances.

Editor American Machinist:

I hereby present an idea of an elevating tool-post, of very simple design. The rest and tool-holder with a knurled nut and two set-screws constitute the whole rig, as will be easily understood from the accompanying sketch. The nut can be drilled with six holes and worked by a wrench if desired.

Another sketch represents a drill-press vise, *A*, especially designed for long pieces, by letting the vise jaws project outside the plate of the press. *B* was designed for similar purposes, and is especially adapted for piston work. I consider both as very handy appliances for a drill-press, and improvements upon the many I have seen in use.

A new milling machine is shown in the engraving intended for different kinds of work. The work represented on the table is a boiler plate where the edge of the man-hole is to be smoothed off after punching. The same operation can be performed upon mud-holes and other regular or irregular work by the help of other attachments, one of which is shown at 2, for circular work, such as links. This sketch only shows a hand-feed, but it can of course be made automatic, so also with the attachment shown. The arbor or spindle might also with advantage for special work be turned into a drill-press. 3 represents a keyseat milling machine, intended for work which is too large for the slotting machine. It consists of a frame attached to timbers suspended from the ceiling. The bar has a slot for the cutter, and driving gear and pulleys outside, driven by a belt running horizontally. The feed is operated by the hand-wheel shown in front. 4 represents a split tool-holder, to be used either for a lathe, planer or slotting machine. It secures a good grip upon the tool which may be relied upon under all circumstances.

N. A. NEILSON.

Chicago, Ill.

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NEW YORK, JULY 22, 1882.

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Machine Shop Economy.

The subject of machine shop economy is one that will not be exhausted until the part it plays in the possible success of a machine business is better appreciated than it is at present. There are certain general principles of economy upon which a business must be established, and which belong especially to the management; but aside and quite distinct from these is the individual economy of the workmen. There are but few manufacturing enterprises in which individual economy plays so prominent a part as it does in the machine shop, and but few in which it receives less attention in proportion to its importance. The problem in any business is to bring about desired results with the least expenditure of *means of all kinds*, and success generally depends upon how well the conditions essential to this end are observed. In many kinds of business the routine is such that a few who direct can attend to the features of economical production for the many who do the work; but particularly this is not true of the machine shop, since here, under the most approved management, a hundred things, separately small, must be left to the judgment and discretion of the workman, and in the problem of cheap production his intelligent co-operation is indispensable. Every machinist knows, if he has ever given the subject any consideration, that it is easy—too easy—to use the common materials and the tools with which he works in such a way as to make an important difference in the cost of production, so far as he is concerned; but few ever think what their own little extravagances, multiplied by the total number of workmen, amounts to in the aggregate.

Men may in their personal affairs understand and practice economy, and yet the same men, proprietor and workmen, fail in the shop to appreciate that the difference between the practice of this virtue and an ordinary disregard of it is about all there is in a business; that it means the difference between fair returns to the proprietor and good wages to the workmen, and shutting up shop.

Lack of economy in small machine-shop matters is not universal, but it is altogether common. There are shops where the science of economy is understood and practised, but there are more where it is scarcely thought of. Shops where it is practiced are readily distinguished, and the workmen have distinguishing characteristics. There is an affinity that keeps the shop and the men together.

A manufacturing machinist who retired from business with a competency some years since, always insisted that he made his money, not by superior business tact or management in a general way, but by strict attention to the small economies of his business. The writer has occasion to remember this man as liberal in the matter of wages, as having his shop equipped with good tools; in a word, as one who used money freely in these directions. But the prominent feature of his management was that economy was exacted in every detail, it being made prominent that its practice had as as much to do as any single thing with the wages a workman could command, as well as with his prospects of a permanent situation.

Probably the chief cause of the lack of individual economy in the work of the machine shop is a defect in the general system of machine-shop instruction. The two ends of doing a job well and doing it quickly are set up before an apprentice, but the end of doing it economically is not thought worth notice. A good mechanic is one who does a job well quickly, *and* economically; that is with the least expenditure of means.

No greater mistake can be made by a mechanic than the (apparently) common one that the waste of material and time, the breaking and improper use of small tools and the ruinous abuse of large ones, affects only the one who pays the bills—the proprietor—yet current machine shop instruction fosters this belief. Instead of the proprietor paying for the lack of economy on the part of his workmen, they pay for it mainly themselves, in receiving, deservedly, less in the way of wages. True, the lack of this virtue may, as it often does, ruin a business, but the workmen share in the ruin.

What is needed is a better appreciation of these facts by mechanics. A measuring of results by their actual cost rather than by the time it takes to accomplish them. Economy is just as surely wealth to the man who receives wages as it is to the one who pays wages. But above all what is needed is the incorporation of the *science* of machine shop economy into the system of machine shop instruction. Let it be understood, as it is not now understood, that the training of an apprentice should be such as to fit him in the future to be, as a workman, as strictly accountable for his part of machine shop economy as the manager, the superintendent, or the foreman is for his. There is a comparatively new field in the direction indicated, which, properly cultivated, will materially change the prospects of many machine enterprises.

Inclinations of Some Inventors.

The worst difficulty some inventors have to contend with is their inclination to carry improvements to excess. A machine involving devices superior to any other of its kind may form the basis of a manufacturing business with the inventor as general superintendent. A profitable business may be assured without further mechanical changes or experiments. But the inventor is frequently an individual who does not know where to stop making changes in any particular direction. It is well if he is able to control his longing to experiment upon the productive plant, or character of the product, so that his innovations do not cost more than the current profits of the concern. Many inventors exceed the limits of prudent shop management in their enthusiastic efforts to create something better than has heretofore been produced. Improvements are always in order when they can be made without pecuniary sacrifice to those most largely interested. Even when improvements are made at a loss, the benefit may accrue to the public, but this is poor satisfaction to the losers.

Introducing New Machinery.

New machines and mecanical appliances are more readily introduced to purchasers than they formerly were. If a party has an article that will commend itself to the mechanical public as superior to that which has generally been employed for the same purpose, he need not wait so long for his reward as he would have been obliged to do a decade or more ago. Not only can more individuals be reached in a given time (owing to increased railroad and telegraph facilities), but those to whose attention a new invention is brought, act more promptly than they did ten years ago. The machinery business is essentially one of radical changes, and, as shops multiply, and the material benefits of improvements become more and more apparent, mechanics and machinery users get accustomed to expect innovations, and are ready to welcome such as present reasonable evidences of superiority. At the same time widespread condemnation of worthless mechanical changes is surer and swifter than in former times.

Vacations and Inconveniences,

This is the season when those who are privileged to have a vacation of one week or more, are studying the list of attractions advertised from mountain and seaside resorts where boarders are wanted. Two large classes of individuals wont take any vacation this summer: workmen who can't afford it, and business men who have no substitutes that can take their places while away. The stay-at-homes can, however, console themselves with the knowledge that a large part of those who do go on a vacation are humbugged by the glowing advertisements of hotels and boarding-houses holding forth, "shady walks and pleasant drives," "boating, bathing and fishing," "fresh milk, butter and eggs," "no malaria, no musquitoes," etc. It is by no means unusual for visitors to summer resorts to undergo for weeks at a time inconveniences that they would not endure two days at home, under the illusion that they are enjoying themselves.

Need of Libraries and Reading Rooms.

One of the most commendable things men of means can do in cities and towns where there are large numbers of workmen, is to found free public libraries and reading rooms. Workmen, as a rule, cannot afford to buy all the books and periodicals they would like to read; and that they should have the means of education within reach is a fact universally admitted. Workers for wages in this country have the prospect of becoming employers themselves, and conducting business on their own account, and many of them do so. It is of the utmost importance that they should be well informed on matters of political economy and the principles that govern business affairs—a knowledge which cannot be acquired from the daily newspapers. More than half the strikes that occur could be prevented were a more extended knowledge of labor and economic questions provided for. We recognize also that employers, as well as workmen, have reasons to study these questions. The former, however, generally have means at their disposal to secure all the books and treatises desired, but not so with the latter. Let libraries and reading rooms be established in every locality where they can be supported by voluntary contributions.

Literary Notes.

The Theoretical and Practical Boiler Maker, containing a variety of useful information for Foremen and working Boiler Makers, Engineers, Employers of Labor, Engineers in charge of Works, Draughtsmen, Boiler Inspectors, Sheet Iron, Copper and Tin Smiths, the General Steam Using Public, and for Scientific Schools and Classes. By Samuel Nicholls, late foreman boiler maker to the Kirkstall Forge Company, Kirkstall near Leeds, England. Second edition, revised and enlarged. Price, 7s. 6d., or $1.83 U. S. money. Published by the author only, Yorkshire street, South Beach, Blackpool Beach, England.

The object of this publication may be best set forth in the author's own words taken from the introduction to his book: "With at least five or six books on the subject of boiler making already at the choice of the reader, the writer's apology is very brief, and rests in the fact that a practical treatise on boiler making which shall be simple snd popular has yet to be supplied.

"He is not aware of any work (with the exception of Mr. Wilson's Treatise on Steam Boilers) that could be put into the hands of a practical boiler maker with the reasonable certainty that its instructions, if followed, would command success. Rules and tables are abundant."

The author being a practical workman, it seems to us is best qualified to furnish to practical men just such a book as they need to advance them in their business. This attempt has been ably made by the combination of theory with practice, using only such theory as is known to correspond with practice, and putting it in simple arithmetical formulas readily understood by any intelligent person. The subject of setting out templates is well treated. In our opinion this is one of the most important features in boiler making, and is probably least understood by our best workmen, who often for want of a reliable practical book have followed the customs of the shop and thus much valuable material has found its way to the scrap heap. Every practical boiler maker and apprentice should at once familiarize himself with this subject as a thorough understanding of it means a saving of money to his employers, as well as a better position and higher pay for himself. A few dollars invested in good practical books, when judiciously studied, have yielded large dividends in a remarkably short time. The table on weights of wrought iron cylinders from $\frac{1}{8}$" to $\frac{3}{4}$" thick, and from one foot up to eight feet in diameter, as well as the article on stayed and unstayed flat surfaces of boilers, with experiments made upon the same, are published in this book for the first time. The questions

f boiler power, repairs, incrustation, safety valves, and boiler appliances are all ably and practically treated. As a rule, the fault practical men find with books is that "they are all too theoretical." We are persuaded that they will not find this fault with the book herein alluded to, but accept it as a plain and practical reference book for daily use in the shop.

The *Sewing Machine News* is a wide-awake, progressive, representative journal of the sewing-machine industry. In accordance with a letter from a correspondent in the last issue, advocating the starting of a department of "Shop Kinks and Factory Notes," it has established such a department, which promises to be a valuable feature hereafter. The correspondent says in his letter:

"About the only thing I have noticed in the *News*, or any of the other trade journals, that would be likely to be appreciated by the average machinist or shop hand, aside from 'Cogwheel's' hints, is an occasional tilt at the ability of the experts, and every now and then an extract from the *American Machinist.*"

AMERICAN FOUNDRY PRACTICE is the title of a book now in press and to be issued in a few weeks by John Wiley & Sons, 15 Astor Place, New York. The author is our contributor, Thomas D. West (foreman of the Cuyahoga Works Foundry, Cleveland, O.), and we need hardly add for the information of our readers, who have carefully perused his articles while they have been appearing in these columns during the last eighteen months, that the work will be not only plain and comprehensible, but a safe and reliable guide for the practical moulder. It will embrace the articles from the pen of Mr. West which have been published in the AMERICAN MACHINIST, with additions, covering loam, dry sand and green sand moulding, also a practical treatise upon the management of cupolas and the melting of iron. The resources of Mr. West in regard to foundry processes are not circumscribed by the limits of the shops in which he has worked. He has traveled extensively among foundries both East and West making good use of notebook and pencil. When there are two or more acceptable ways of doing a job he explains them in detail with the special advantages of each. The work will be addressed to *moulders who have learned the trade* rather than to apprentices, and therefore will not be encumbered with cuts and descriptive matter which every foundryman is (or ought to be) familiar with. Apprentices, however, will doubtless find it more valuable to study on that account. Mr. West recognizes the fact that foundry practice as well as machine shop practice is *progressive*, and that many methods of doing work which were considered the best a few years ago, are now obsolete in shops that keep abreast of the times.

We are not advised as to the selling price of the book. It will be fully illustrated.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(245) J. E. B., Bound Brook, N. J., asks: 1. What is the best packing for steam valves and pipe? *A.* If you mean packing for stuffing boxes there are a half dozen varieties you can buy at supply stores, any of which is good. 2. How can I drill iron that has been chilled? *A.* See answer to C. B.

(246) C. B., Worcester, Mass., asks: How to temper a drill so as to drill spring steel and chilled iron? *A.* Heat to a cherry red and cool in mercury; or you can try cooling by forcing it into a lump of rosin. The steel of which the drill is made must be of the best and forged with care.

(247) J. D. R., Gardner, Mass., asks: Please inform me where I can obtain material and instruction for copying drawings by the blue process? *A.* We presume you can obtain the material from dealers in drawing instruments and material generally. The only dealer we know of positively who keeps it is G. S. Woolman, 116 Fulton street, New York. You will find full instructions in our issue of Oct. 8, 1881.

(248) Engineer, Montreal, Canada, writes: I am running a compound beam engine and getting 26" vacuum, with the temperature of feed water 120°. Can I gain by increasing the vacuum and decreasing the temperature of the feed? *A.* If your air pump and condenser are in good condition, as we should assume they were, you will gain by increasing the vacuum.

(249) L. D. B., Hartford, Conn., asks: 1. I have just finished a three-years' apprenticeship with a first-class machine company, and wish to become competent to take charge of a shop of my own. What course would you advise me to pursue? *A.* Work a few years in different shops and spend your leisure time in study. 2. Which will sink the easier in water—a hollow sphere filled with air or one in which there is a vacuum? *A.* Other things being equal, the one filled with air.

(250) W. H. R., Spokane Falls, Washington Ter., asks: Please tell me how the angle of the pitch line to the axis [apex] on bevel gears is correctly formed? *A.* Draw two lines representing the center lines of the two shafts, set off the position of the pitch line of the gear at its greatest diameter and draw a line from this point to the point where the two lines cross each other. This line, or so much of it as represents the breadth of face, will be the line you refer to.

(251) G. O., Worcester, Mass., asks: 1. What are the patents on barbed wire fence that enable one company to control its manufacture? *A.* There are several patents which have a bearing, and which we believe are largely owned by one concern. Some of them are quite old. 2. Why are two wires used instead of one? *A.* It would seem to be easier to fasten the barbs by using two or more wires; besides the failure of one wire, as through a flaw, would still leave one to hold. Perhaps there are other reasons why two wires are used.

(252) F. G., St. Louis, Mo., asks: 1. Do you think it possible to pump water at a temperature of 210°? *A.* Yes. 2. What is the highest temperature on record of the water from a Stillwell heater? *A.* We have no record of the kind referred to. Undoubtedly the manufacturer will furnish you with the desired information. 3. In an upright blowing engine, steam cylinder 5 feet diameter and 9 feet stroke, 18 revolutions per minute, blowing cylinder 10 feet diameter and 9 ft. stroke, can the power of the blowing cylinder be estimated the same as the steam cylinder, and is there any rule to find the equivalent in pounds pressure, the resistance of the furnace being constantly changing? *A.* There is no way except by the use of an indicator.

(253) J. P. R., Memphis, Tenn., asks: 1. Would an automatic car coupler pay, if capable of coupling every time without fail? *A.* If you can make a coupler a good deal better than any of a large number of others that have been tried by those who were quite as sanguine of success as you are, and could get it adopted by railroads, it might pay. There are many difficulties in the way of accomplishing what you propose to do, and unless you are thoroughly acquainted with the whole matter, we advise you to investigate before investing much money. 2. What would be the maximum price at which it could be sold? *A.* We cannot say. 3. Would it be difficult to get railroads to adopt it? *A.* Yes. 4. Would being able to uncouple on the run be an advantage? *A.* Yes. 5. What would be the cost of securing a patent? *A.* About sixty-five dollars.

(253) T. H., Amherst, N.S., writes: I am designing a machine in which I will have a 2" shaft running at 1,600 to 1,800 revolutions. I want to obtain a reciprocating motion of about 1¼" in such direction that it could be convenient to take it from an eccentric on the shaft, which could be placed close to a good firm bearing, and could be made wide enough to take an eccentric strap 3" or 4" wide. The eccentric rod would be 8" or 9" long, and it and one-half the strap could be cast in one piece, of steel or malleable iron. I could do with a lower speed on the reciprocating motion, and I could get it from a crank on a separate shaft driven from 2" shaft, but I would much prefer having it direct from 2" shaft, if it can be done. Would you consider it practicable to do so? *A.* If the work is quite light you can use the eccentric, as you describe, by making it as small in diameter as it is possible to do, and counterbalancing the eccentric and (experimentally), to some extent, the reciprocating parts. It will require excellent fitting and very careful attention, so that on the whole the slower motion from the other shaft would probably be preferable.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Portable Forges, $10. Holt M'fg Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St. cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Do you manufacture Hardware or House furnishing goods you wish sold in New York? If so, address Manufacturer's Agent, care of AM. MACHINIST.

"Steam Economy," 124 pp., cloth, $1.00 (illustrated), points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut off gears; price, $1.00.

Hardware manufacturers' attention!—The best alarm money drawer in the world.—Cannot be picked.—Easiest working.—3 distinct blows on alarm bell.—No winding. Walter L. Cheney, 34 Beach Street, Boston, Mass.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

For Sale. Price, $7.60. "The Mechanician," by Cameron Knight, a treatise on the construction and manipulation of tools for the use and construction of young engineers and scientific amateurs. 1,147 engravings. Address, BOX 1, Care AMERICAN MACHINIST.

"Sibley College of Mechanic Arts, Cornell University.—Entrance examinations will be held June 12th and September 11th, 1882. For the register and catalogue just issued, containing reorganized courses of instruction, scientific and practical, including draughting, machine construction, general shop work, etc., apply to the President of Cornell University, Ithaca, N. Y."

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous Illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

To Machinists, Pattern-Makers and Millwrights—I have compiled the most complete table of the diameters of Pitch Line of Toothed Wheels ever published. This table supplies a long-felt want, as the numerous testimonials I am receiving will attest. The table is very complete in every particular, and from it you will get a result at a glance without calculating. No algebraic terms are used; it gives the pitch line of toothed wheels from ½ to 4 inches pitch, and from 12 to 100 teeth. Third edition now on the press. Orders promptly filled. Price, $2.00. Address, Wm. T. Ross, First and Washington streets, Louisville, Ky.

MANUFACTURES.

The Richardson foundry, Coxsackie, N. Y., is being enlarged and improved.

Jerome B. Secor, Bridgeport, Conn., is about to bring out a new shaping machine.

The Parker Carriage Goods Co., Cincinnati, has been incorporated, with a capital of $30,000.

The Michigan Tool Works, Grand Rapids, Mich., are building engine lathes of their own design.

The Youngstown, O., Malleable Iron Co. will enlarge their capacity by erecting an addition 70 x 150 feet.

The Huntsville (Ala.) cotton-seed oil mills are shipping hundreds of tons of cotton-seed meal to Germany.

The Whipple Manufacturing Co., Cleveland, have completed their extensive works for the manufacture of builders' hardware.

The Philadelphia Smelting Company have patented a process by which it is claimed pure copper castings can be made perfectly solid.

Russell & Co., Massillon, Ohio, are making an extensive addition to their works, especially with a view to building 30, 40 and 50 horse-power engines.

The Bell & Thomas Manufacturing Company has been incorporated for the purpose of doing a brass and metal business at Milwaukee, Wis., capital $50,000.

The Holyoke Foundry, of Holyoke, Mass., hopes to be ready for business in about sixty days, and its capacity will be about seven tons a day of general work.

The White Mountain Freezer Company have broken ground for the erection of a new foundry in connection with their works in Nashua, N. H. The foundry will be 75 by 50 feet.

Jas. F. Hotchkiss, 84 John Street, New York, has just issued a fifth and a sixth edition of 5,000 each, of his "How to Keep Boilers Clean," which he will send to any one free, upon application.

The car shops at Watsontown, Northumberland county, Pa., which have been lying idle a month or more, have just received a contract for building four or five hundred cars, and will be put into immediate active operation.

We have received from the Akron Iron Company some neat nickel-plated paper weights made from short sections of their hot polished shafting. This shafting is deservedly popular with users of machinery and the demand for it continues as hot as ever.

The machinery for the Muscogee Oil Works, located at Columbus, has been contracted for, and the contracts for the building satisfactorily let. The main building will be three stories high, and the whole establishment will cover an acre of ground.

The Ludlow Valve Manufacturing Co., Troy, N. Y., advise us that never in the history of their extensive and well-organized business have they been so pressed with orders as, so far, during the present year. They see no signs of falling off in their business.

The Northwestern Manufacturing and Car Company, Stillwater, Minn., was organized May 2, 1882, with a capital of $5,000,000, purchasing the business of Seymour, Sabin & Co. They employ 1,200 hands, and make, besides threshers and farm engines, freight and passenger cars.

W. P. Davis, North Bloomfield, N. Y., writes us: My works run day and night, from January 1st to April 1st, when I increased my facilities until I thought I could keep up with orders. Now I am again obliged to start up on overtime, and judging from letters received from users of my machines, shall continue to have a large sale for some time to come.

C. E. Billings, President of the Billings & Spencer Company, Hartford, Conn., has purchased the old file shop property adjoining the works, and the company will put in more drops and hammers at once. They have just purchased one 850 and one 400 lb. drop, and a large trimming press. They are as full of orders as ever.

Gross, Shaw & Co., Auburn, Mass., write us that in addition to their standard traverse drill, they have commenced the manufacture of larger back-geared machines of the same class, which will be furnished when required with automatic stop motion for gauging the depth of holes. Hill, Clark & Co., 36 Oliver Street, Boston, Mass., are the Company's Boston agents.

Those interested in the new Potomac Manufacturing Company of Alexandria, Va., say that before fall the manufacture of steel car wheels and car axles will be in active operation at the company's works in Alexandria, and that a rolling mill for steel plates will also be at work there, and that the keel of an iron steamship will be at their shipyard by the time the wooden vessel now in process of construction there is completed.—*Baltimore Journal of Commerce.*

The census report of manufacturers of the cities gives the following statistics for Philadelphia: Number of establishments, 8,337; capital, $170,495,191; average number of hands employed, 173,862 total amount paid in wages during the year, $60,606,287; value of materials consumed, $187,169,375; value of products, $301,591,725. Among other concerns, there are 187 machine shops, employing 7,603 men; 97 establishments engaged in the manufacture of iron and steel of different descriptions, employing 7,518 men; 272 tin, copper and sheet iron works, employing 2,211 men.

The Canadian *Manufacturer* states that the Canadian Pacific Railway Company has transformed the town of Perth into a hive of industry. Its workshops there are nearly completed, and 200 men are now engaged in them. The company has one shop for car building 200x75 feet, another for wood-working machinery 160x75 feet, a smith and machine shop 120 feet long, a dry kiln, a saw mill and a boiler house. The motive power is supplied by a 150-horse power engine. The workmen include some of the best mechanics in Canada, and it is intended to build all the passenger and freight cars at that point. The hotels and boarding houses are full, and there is not sufficient accommodation.

Geo. R. Meneeley & Co., manufacturers of Hopkin's patent self-fitting journal bearings at Atlanta, Ga., are now making these bearings for all the Southrn railroads. They have the largest manufactory South, and are turning out one of the best bearings now in use. This firm built a large and commodious foundry in Atlanta two years ago for the purpose of meeting their Southern orders promptly. Their capacity is 2,000 pounds of metal finished per day. Their foundry has all the modern improvements, and is a model in every particular. They are now having plans made for an addition of 25x90 feet, two story, brick, slate roof.—*Chattanooga Tradesman.*

Osgood and MacNaughton, Albany, N. Y., have shipped during the last week three Osgood Boom Dredges, and will ship another during the present week. Of these, one goes to Baltimore, Md., for general contract dredging; one to Galveston, Tex., for the Galveston Wharf Company's use; another goes to Mexico, for the Mexican Government, and a fourth to the Monongahela Dredging Company, Pittsburg, Pa. This firm are building another for the United States Government, to be sent to Rock Island, Ill., for use on the Mississippi river, and another for Geo. W. Parsons, Salisbury, Md., for use on the Wicomico river. These machines range in price from $5,500 to $19,000. They are built at the works of Townsend & Jackson, Albany, N. Y.

Machinists' and Engineers' Supplies.

NEW YORK, July 6, 1882.

The general state of the supply market since our last issue has been quite dull as a part of Saturday and Monday and Tuesday were observed as holidays. Pig Iron continues dull which we quote at $25.50 to $26 for Foundry No. 1., $23 to $24. for Foundry No. 2X. Gray Forge $21. Foreign Iron continues firm. We quote Gartsherrie at $25.50 to $26; Coltness $26.50 to $27; Summerlee, $25.50 to $26; Glengarnock, $24 to $24.50; Carnbroe, $23 to $23.50; Eglinton $22.50 to $23; Langloan, $25.75. Copper very dull at 18¼c. for Lake Superior. Banca Tin 28c. Australian Straits and Malacca, 21¾c. Billiton, 22c. Spelter, 5.60 to 5.65; Refined, 8c. to 8¾c. Lead, 4.85 to 4.95; Refined, 5c. Antimony, Hallets, 11¼c. to 11¾c.; Cooksons, 13¼c. to 13¾c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A Machinist, experienced in designing and superintending machinery, desires a position. D, this office.

Wanted—Machinists for portable engine work. The E. M. Birdsall Co., Auburn, N. Y.

Wanted—Situation as Mechanical Draughtsman. General Machinery or marine work preferred. Address G, 216 Raymond Street, Brooklyn.

Wanted—Situation as foreman of machine shop. Thirteen years experience in Western States. J.E. McConnell, Iowa City, Iowa.

Wanted—A practical machinist to take charge of a small jobbing shop; one who understands engine building and repairing. Address Eagle Foundry, Little Rock, Arkansas.

Wanted—An experienced die-maker for gang boss over 4 or 5 men on square and irregular tin dies, State wages wanted; also amount of experience, and by whom formerly employed. Ferracute Machine Co., Bridgeton, N. J.

Blacksmith Wanted—A man who understands tool forging, principally of steel. A permanent situation and good wages to the right man. Apply by letter or in person to Joel Hayden Brass Co., Lorain, Ohio.

Brass Finishers—Fifty good workmen accustomed to steam and water work can find permanent employment and good wages, or a chance to take piece work. Joel Hayden Brass Co., Lorain, Ohio.

Wanted—A man of fair education and address, having a good knowledge of printing machinery, may make a desirable engagement by addressing, Spottiswoode, care AMERICAN MACHINIST, stating experience had in above line.

Wanted—A thoroughly practical machinist and draughtsman as foreman, and to make drawings for a small shop with first-class tools, working 15 to 20 hands on special tools and machinery. Give reference and salary expected. Addess X Y Z, office AMERICAN MACHINIST.

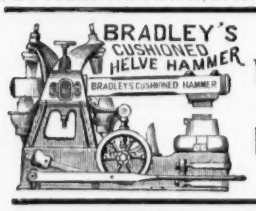
Wanted—One first-class planer hand and three first-class lathe hands who have been accustomed to work on machine tools. Also, two first-class machine moulders, must be sober and steady men. None others need apply. Address JOS. B. Reed, Cairo, Ill.

A mechanical engineer, at present manager in a machine tool manufacturing business, will soon be at liberty and desires a position. Is well up in stationary engine, tool and general designing and construction. Address A. J., Box G, Auburn, Me.

Wanted—Situation as Foreman Moulder by a first-class practical Moulder, 28 years, experience at the business; accustomed to all kinds of light and heavy work, core-making, mining of metal and the construction of patterns; best of references. Address, J. Kathes, office AMERICAN MACHINIST.

For Sale—Jobbing Foundry and Machine Shop. A bargain for parties with a limited capital. For full particulars address, D. C. Baughman & Sons, Albion, Ind.

Mr. R. Kant performs all kind of drawings and figurings, calculations. Consulting can be made either personally or by letter. Address, Drugstore, 1 & 2 Charlestown street, Boston, Mass.



STANDS TO-DAY
Without an Equal.
OVER 700 IN USE.
Bradley & Co.
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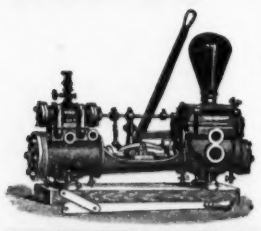

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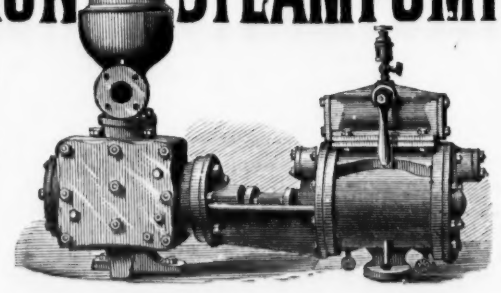

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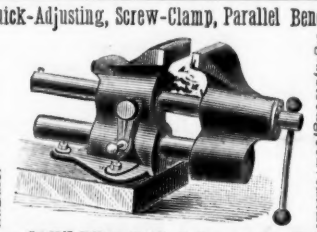

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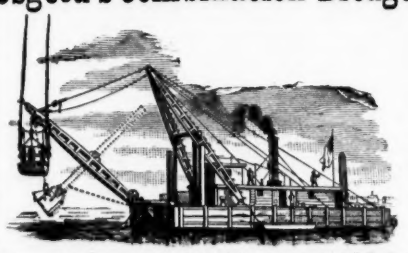

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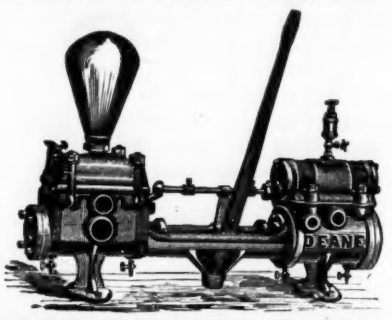

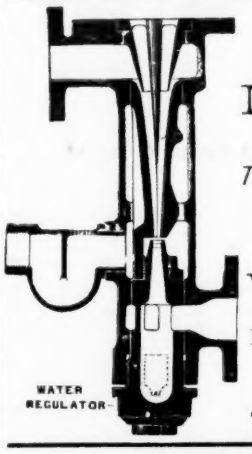

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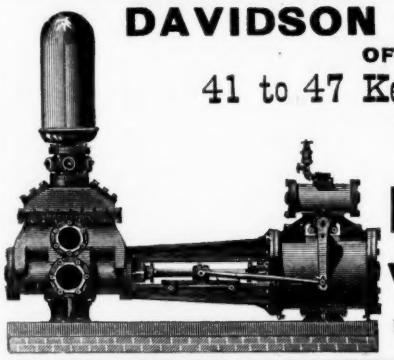

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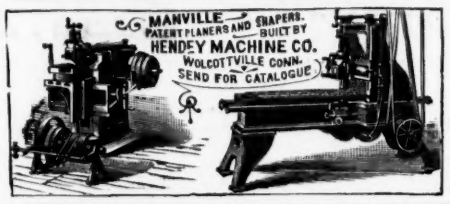

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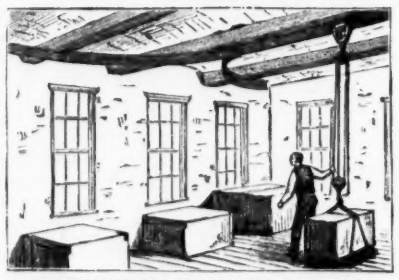

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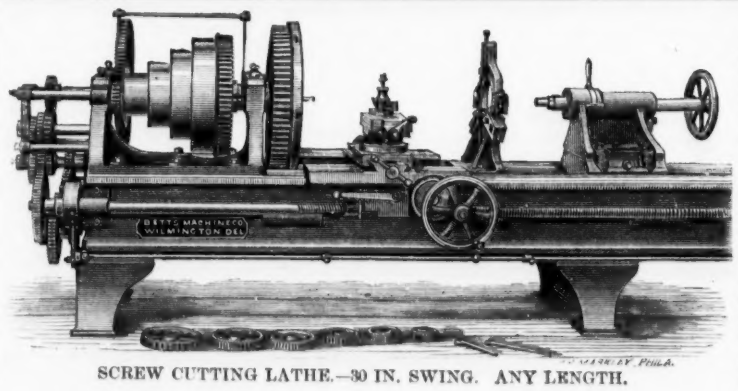

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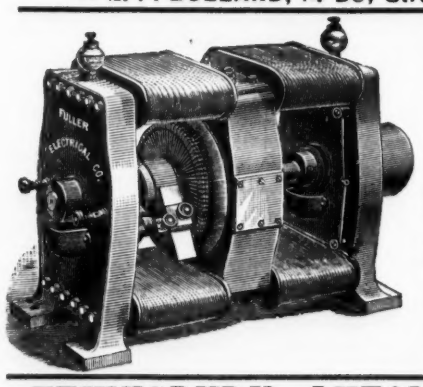

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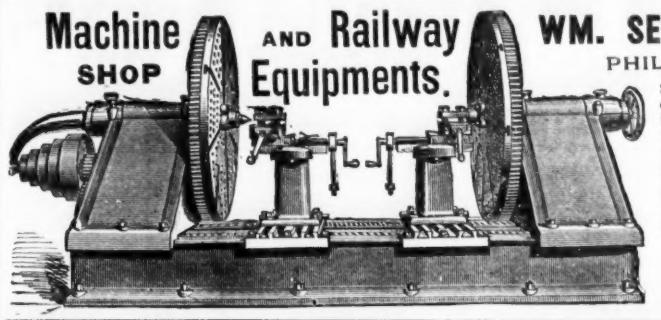

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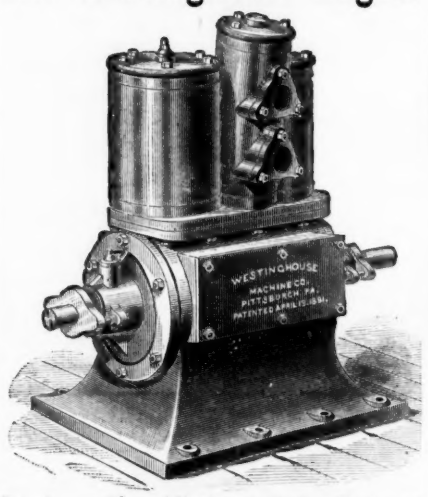

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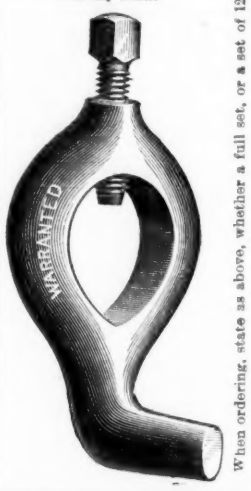

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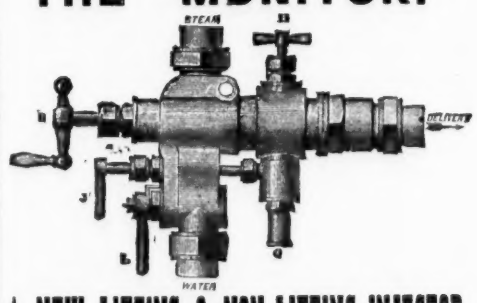

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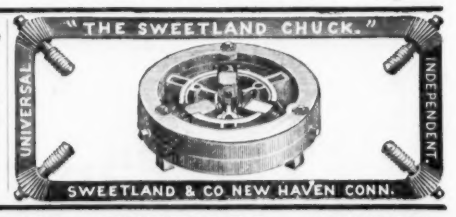

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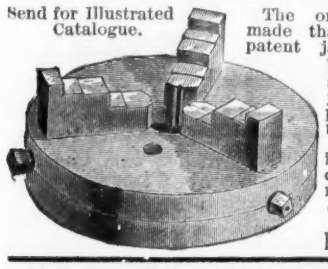

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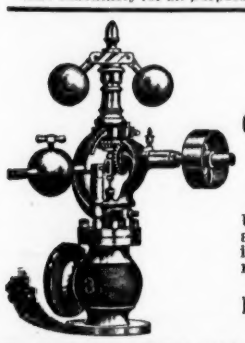

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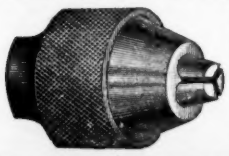

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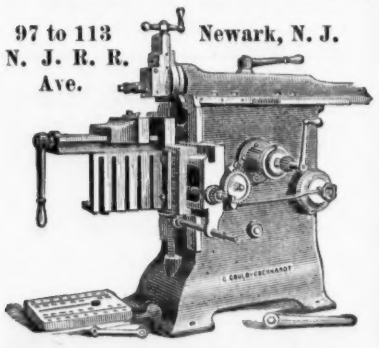

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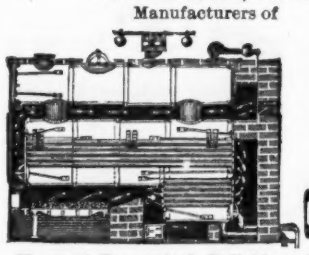

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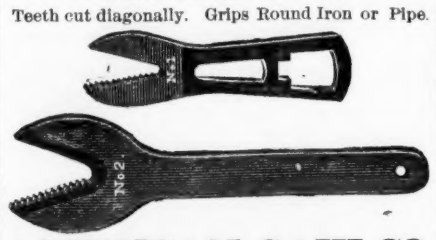

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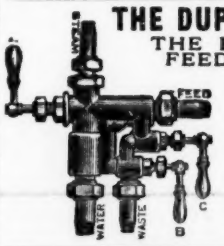

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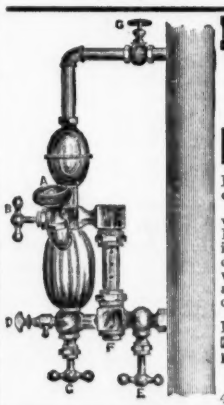

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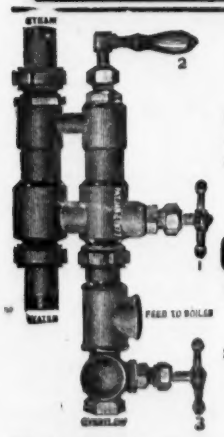

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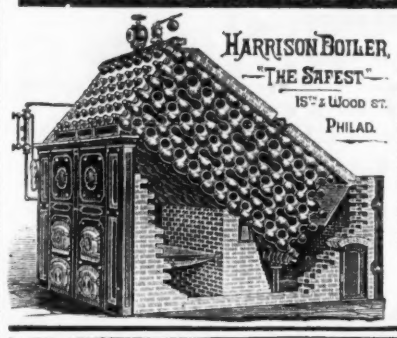

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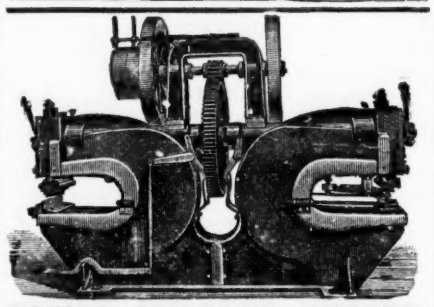

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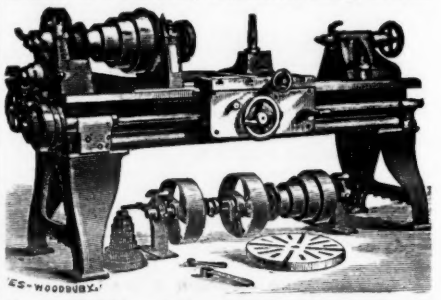

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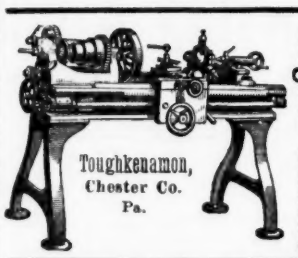

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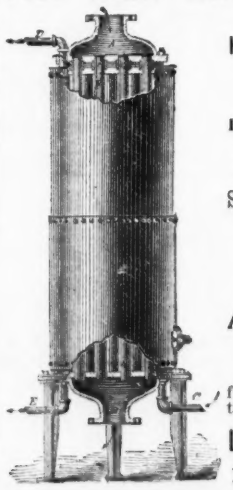

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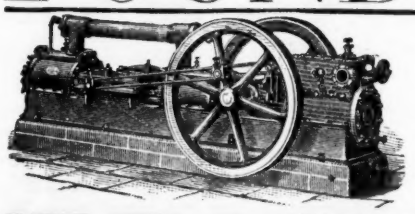

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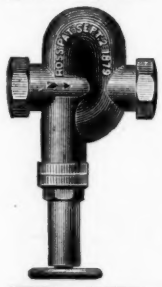

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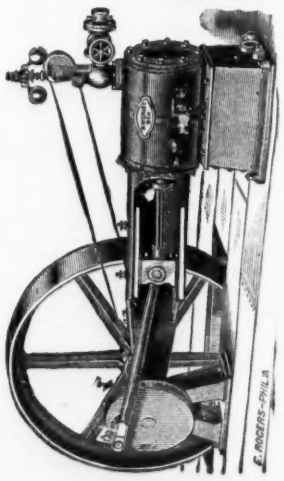

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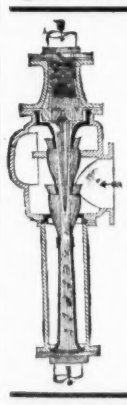

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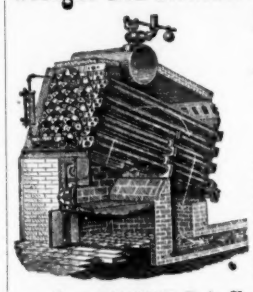

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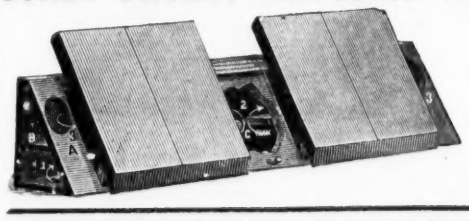

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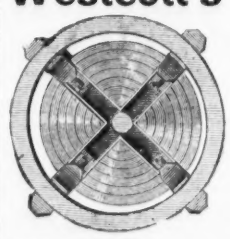

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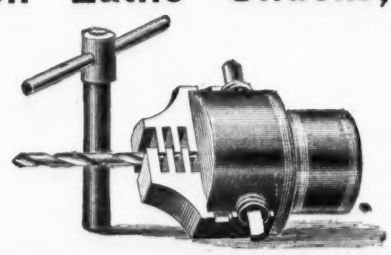

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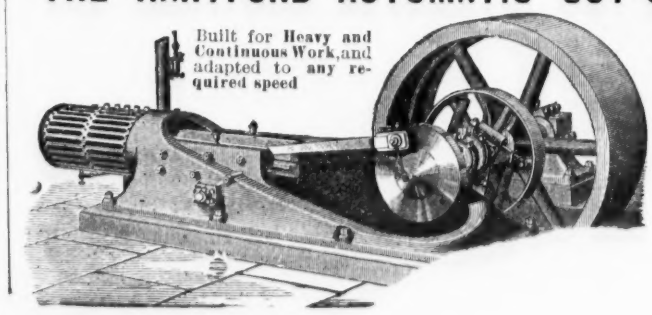

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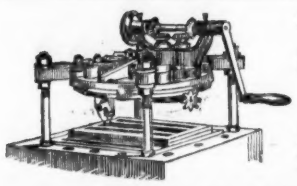

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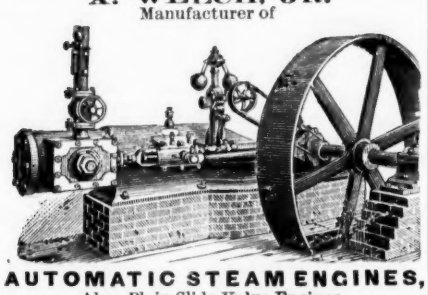

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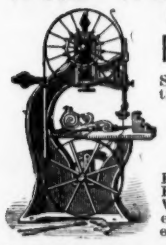

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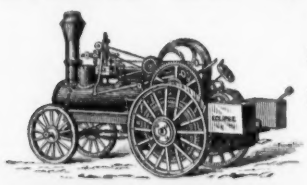

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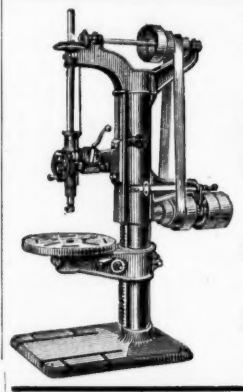

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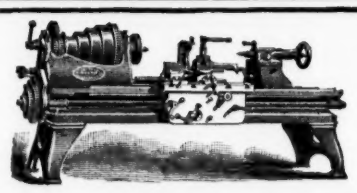

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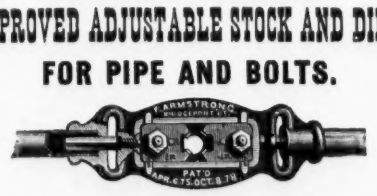

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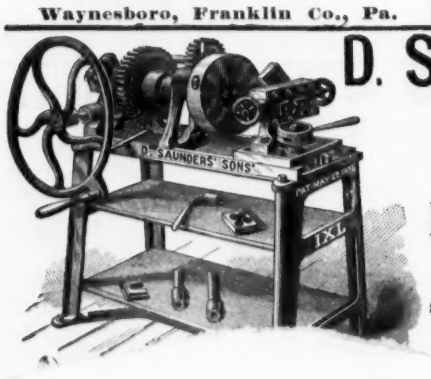

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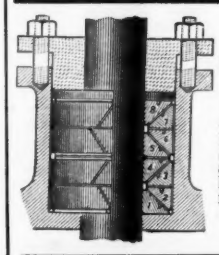

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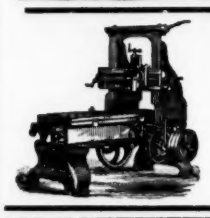

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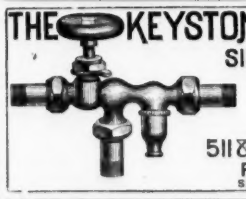

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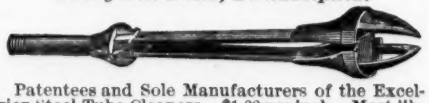

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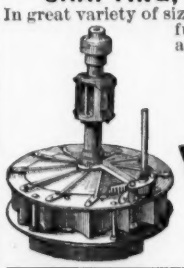

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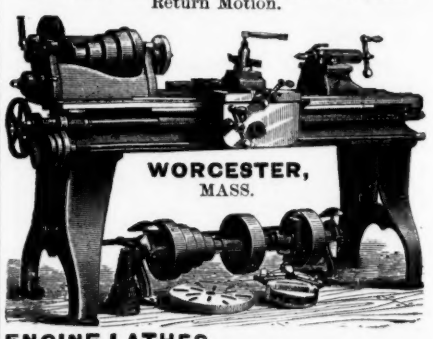

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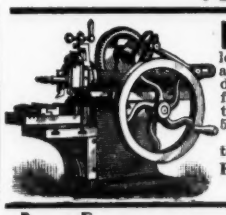

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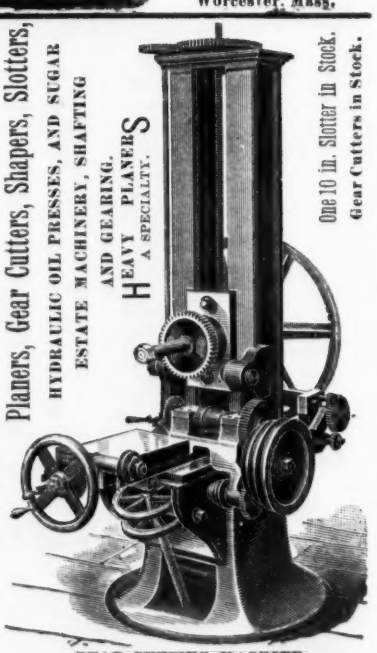

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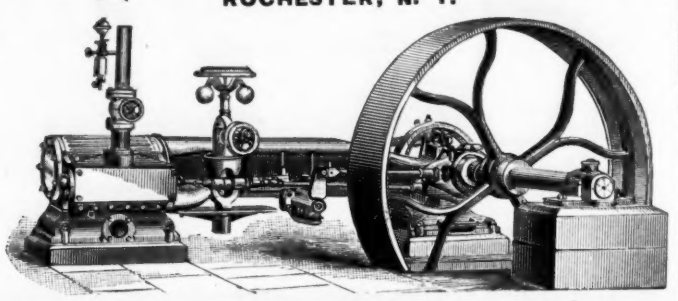

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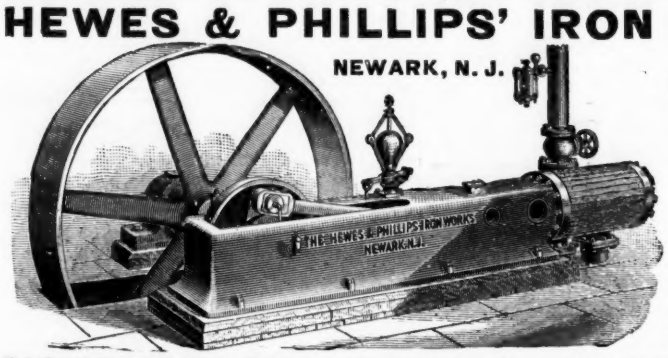

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38 inch, triple-geared (bed to suit).		Fitchburg.
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19 " "	10 and 12 "	Gray.
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17 " "	6 "	Johnson.
16 " "	6 and 8 "	Fitchburg.
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30 inch x 30 inch x 8 foot,	Fitchburg.
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60 inch radial drill, double-geared, self-feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.
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One " " 24 in. x 14 ft. Ames, "
One " " 24 in. x 12 ft. " "
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Three Engine Lathes, 20 in. x 12 ft. Ames. New.
Three " " 20 in. x 10 ft. " "
Three " " 20 in. x 8 ft. " "
One " " 20 in. x 10 ft. Jones&Lamson. New.
Two Engine Lathes, 18 in. x 7 ft. Armsley & Harrington. Good order.
One Engine Lathe, 16 in. x 6-7-8-10-ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
One " " 15 in. x 6 ft. with Turret. Flathers. New.
Two Engine Lathes, 14 in. x 6 ft. Star Tool Co. New.
Six " " 13 in. x 6 ft. Ames. New.
Two " " 13 ft. x 5ft. " "
Six Hand Lathes, 12 in. x 5 ft. Hendey. New.
One Crank Planer, 12 in. Belden. New.
One Planer 16 in. x 3 ft. Belden. New.
One " 20 in. x 4 ft. Lathe & Morse. Good order.
One " 20 in. x 4½ ft. Putnam. New.
One " 24 in. x 6 ft. —— Good order.
Two " 24 in. x 6 ft. Ames. New.
One " 28 in. x 6 ft. Gleason. New.
One " 37 in. x 10 ft. Second-hand. Good order.
One 6 in. Stroke Shaper. Boynton & Plummer.
Two 9 in. Stroke Shapers. Hewes & Phillips.
One 10 in. Stroke Shaper. Pratt & Whitney.
One 15 in. Stroke Shaper. Hendey. New.
One 10 inch Stroke Shaper. Gould & Eberhardt. New.
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Three Screw Machines. No. 1. Pratt & Whitney. Good order.
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Three 4 Spindle Drills. No. 2. Pratt & Whitney.
One 4 " " Garvin. Good order.
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Two 20 in. Upright Drills. Prentiss. New.
One 22 in. Upright Drill. Prentiss. New.
One 24 in. Upright Drill. Ames. New.
One 30 in. " " Prentiss. New.
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Three Sensitive Drills.
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14 Lincoln Millers and Vises. Good order.
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1 " " 13 in. x 5 ft. & 6 ft. Ames. "
1 " " 16 in. x6, 7 & 8 ft. Ames. "
1 " " 18 in. x 8 ft. Lodge & Barker. "
1 " " 24 in. x 12 ft. Fifield. "
1 " " 30 in. x 16 ft. Perkins. "
1 " " 22 in. x 18 ft. " "
1 " " 24 in. x 16 ft. " "
1 " " 24 in. x 12 ft. Michel. "
1 " " 12 in. x 5 ft. Prentiss. "
1 " " 12 in. x 4 ft. " "
1 Fox " 15 in. x 5 ft. Pike & Dean. "
1 15 in. x 4 ft. Turret Lathe. Lodge & Barker.
1 Plain Engine Lathe, 16 in. x 4 ft. "
1 Planer, 28 in. x 28 in. x 6 ft. A1 order.
1 " 16 in. x 16 in. x 3 ft. "
1 " 24 in. x 24 in. x 6 ft. "
1 " 26 in. x 26 in. x 7 ft.
1 Upright Drill, 16 in. Prentiss. "
1 20 in. Upright Drill. " "
1 30 in. " " "
1 20 in. Shaper. Gould & Eberhart. "
1 15 in. Shaper. "
1 Pratt & Whitney No. 2 Screw Machine. Fair order.
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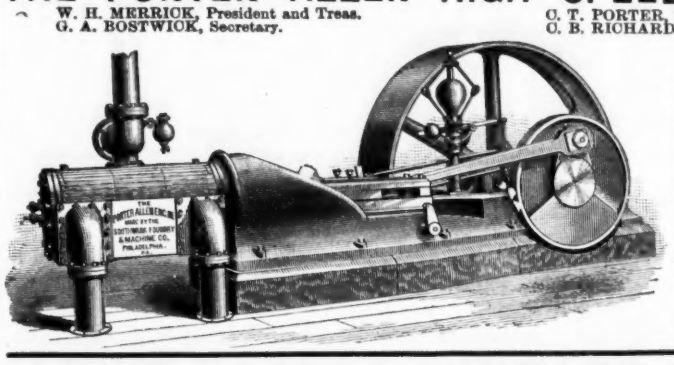

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Orders solicited for Iron and Brass Castings in the rough.

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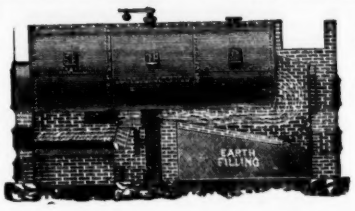

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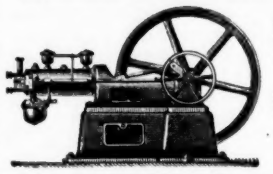
NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.

Started Instantly by a Match, it gives full power immediately.

When Stopped, all Expense Ceases.

No explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running.



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FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS,

JAS. HUNTER & SON, North Adams, Mass.

NEW & SECOND-HAND MACHINERY.

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1 Engine Lathe, 14 in. swing x 6 ft. bed. Ashton Hand. New.
1 Engine Lathe, 11 in. swing x 5 ft. bed. New.
1 " " 11 in. " x 4 ft. " Prentice. New.
6 " " 11 in. " x 5 ft. 6 in. bed. New.
1 Hand " 12 in. " x 4 ft. " Young. "
1 Back Geared Foot Lathe, 9 in. swing x 4 ft. bed, with Slide Rest and 2 Chucks, mounted on wooden bench. Second-hand. Good order.
6 Leader Foot Lathes. New.
Brigg's Foot Lathes. Nos. 1 and 2. New.
Polishing " Small and Large. New.
1 Upright Drill, 2 Spindles. Garvin. "
1 Sensitive Drill. "
3 Light Drilling Machines. "
A full assortment of Lathe Attachments, Countershafts, Chucks, Drills, &c., &c.

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IRON PLANERS,
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ENGINE LATHES,
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A GENERAL LINE OF

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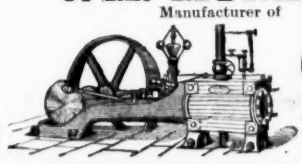

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1st Av. cor. 30th St. New York.

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1 30 in. x 30 in. x 8 ft. Planer. New. July.
1 42 in. Swing, 16 ft. bed, New Engine Lathe. July 15
1 42 in. " 20 ft. " " " " "
1 36 in. " 12 ft. " " " " "
1 22 in. swing, 13¾ ft. Bed Engine Lathes. June.
1 19 in. swing, 10 ft. Bed Engine Lathes. "
1 11 in. Shaper, 25 in. Traverse. July 10.

The following on hand:

1 30 in. swing, 18 ft. Bed Engine Lathes. New.
1 26 in. " 16 ft. " " New.
1 22 in. " 11½ ft. " " "
2 22 in. " 12 ft. " "
4 19 in. " 8 ft. " " "
2 18 in. " 8 ft. " " "
1 18 in. " 11 ft. " " Tilting carriage.
5 15 in. " 6 ft. " " New.
1 Square Arbor Fox Lathe. New.
1 15 in. swing, 9 ft. Hand Lathe. New.
3 12 in. " 6 ft. " " "
1 10 in. " 4½ ft. Bed Hand Lathe. New.
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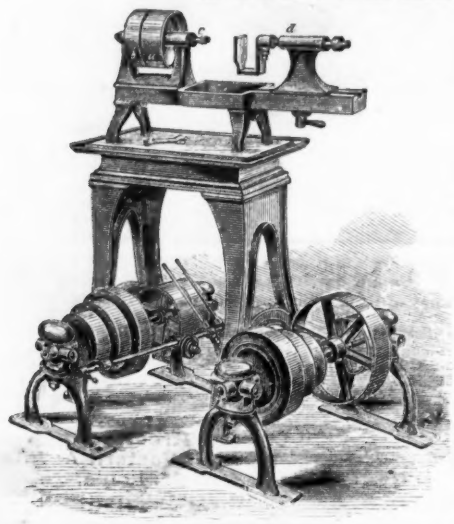

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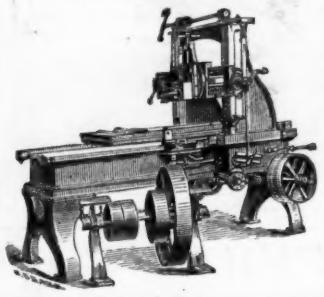

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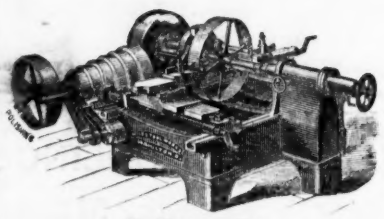

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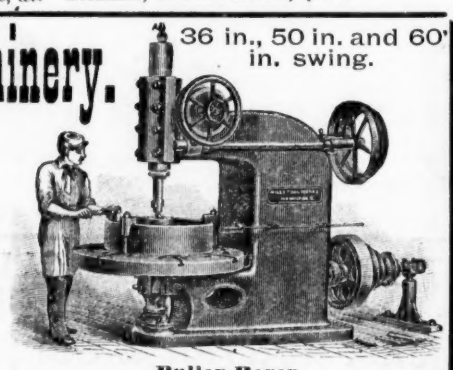

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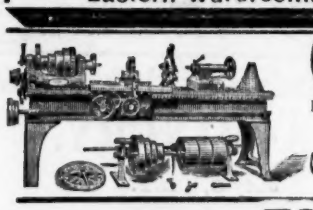

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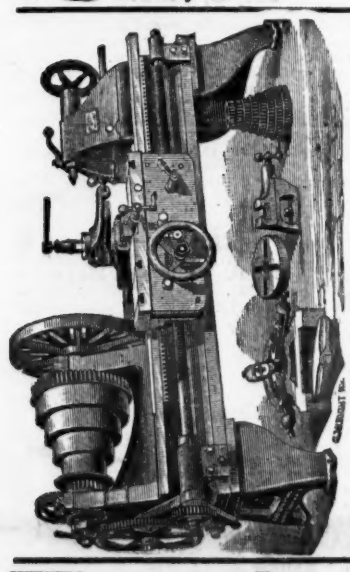

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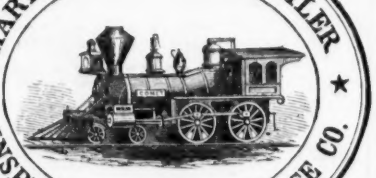

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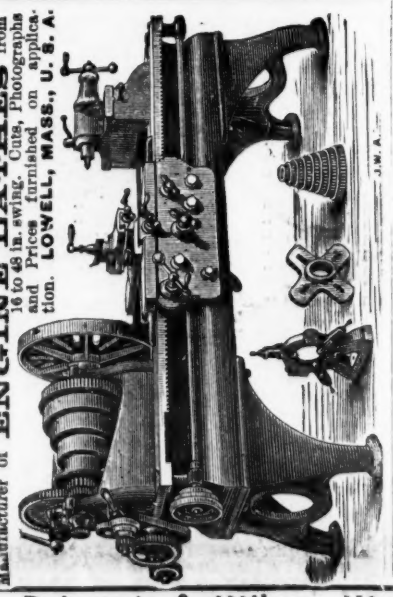

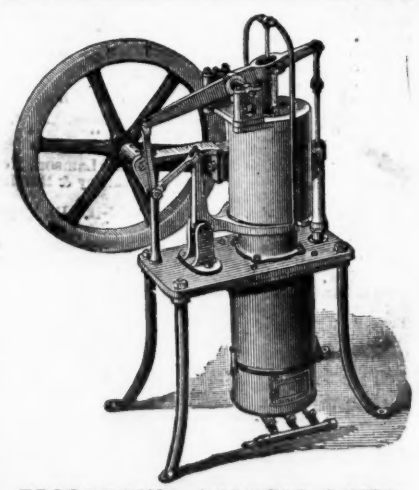

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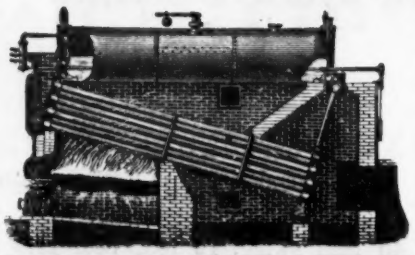

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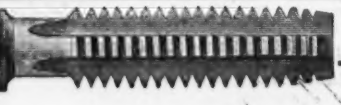

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